Carlson Drill Grade

# Reference Manual v.5.0

www.carlsonmachinecontrol.com

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# Carlson GRADE

## TECHNICAL SUPPORT

Contact information for tech support for *Carlson Grade* and *Grade Supervisor* is provided by:

Carlson Software, Inc. Corporate Headquarters Maysville, KY, USA Tel (606) 564-5028 Fax (606) 564-6422

**Customer Service, Technical Support, Repair**
Email: support@carlsonsw.com

**Customer Support**
CPMCSupport@carlsonsw.com

**To Report Service Issue**
CPMCservice@carlsonsw.com

**To Report a Bug**
CPMCbugs@carlsonsw.com

**To communicate an enhancement for product idea**
CPMCidea@carlsonsw.com

**To Request Information about Carlson Positioning & Machine Control Products**
CPMCinfo@carlsonsw.com

If you need assistance with your Carlson Software products, please call by telephone, or send an e-mail to the address above. Support hours are Monday through Friday, 7:00 A.M. to 7:00 P.M. (EST, GMT -5 hours).

**www.carlsonmachinecontrol.com**

## Software License Activation

To activate a license of Carlson Grade Software, first install it on the control box you wish to license. The current version can be found here:

http://carlsonmachinecontrol.com/support/downloads/

Once installed go to ToolsAbout>Support>Product License>Activate License and record the 20 Digit code provided there. Please remember this is not the Serial Number for the license, just the activation code. The Serial Number can be found in the invoice from the purchase. If you purchased the software from a licensed Carlson dealer, please contact them to obtain the serial number. Once you have the 20 digit code and the serial number go to :

http://carlsonmachinecontrol.com/support/uoa-codes/

There you can complete the form to obtain a license. Most licenses will be returned within a few minutes, but please allow up to 24 hours to obtain the UOA file. Once you have downloaded the file, press "Load License" from the 20 digit code screen. From here you can navigate to a location on the Local drive of the control box, or to a USB or other external drive and locate the file "cg.uoa." Select the file and press "Load." This will activate your license of Carlson Grade Software.

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# ABOUT CARLSON GRADE

## CARLSON GRADE:

Carlson Grade is a machine control product introduced by Carlson Software in 2005 which is built from the ground up. Carlson Grade can be setup and implemented with a wide variety of Machines. Carlson Grade supports multiple brands of GPS/GNSS and radio receivers. Carlson Grade Products as well as other Carlson software products are committed to Open Positioning Architecture (OPA) supporting many data formats and sensor technology. We are open to work with most anyone providing the freedom of choice in the positioning and land development marketplace.

**All Heavy Equipment Configurations Inside One Product:** Carlson Grade has configurations for blade-based applications (dozers and motor graders), track-based applications (dozers, shovels, loaders, scrapers), bucket position on excavators, certain front-end loaders, drill navigation and logging, Bucketwheel navigation, and dragline swing monitoring, all built into one software package. A single Carlson Grade purchase can be used one week on an excavator, another week on a dozer, and a third week on a drill, as needed. If purchased for a drill and work is suspended, Carlson Grade can be transferred to a "Grade Ready" Dozer and used for monitoring Cut / Fill's to a design surface. Simply configure Grade for the operating method and select the appropriate equipment icon.

**All Major Applications (Mining, Construction, Landfills, Equipment Fleets):** Carlson Grade has one install. However, through the use of a UOA file, your software can be setup specifically for mining, construction or landfill applications. The mining configuration removes the up-down arrows for grade adjustment, so popular in construction (surface versus sub-grades), eliminates the hydraulic control display areas, adds the option of coal or ore quality, maximizes screen "real-estate" for plan, section and profile views and generally simplifies the user interface. The construction configuration includes hydraulic blade control and on-off status, up-down arrows for grade adjustment, and more screen space devoted to text outputs of pitch, roll and blade elevation. If tilt sensors are used, even "indicate only" grading (no hydraulics), Carlson Grade shows forward slope and blade or track cross-slope. You can even apply tilt sensors to "slope boards" for precise grading of steep embankments. The landfill configuration has options for coloring the screen by number of passes or determining compaction accomplished with each pass. The operator can set what small threshold of drop represents "refusal" and indicates full compaction. For all applications (and particularly useful for mining), a "fleet" option can be activated for operator log-in, field check and reporting.

## OPERATING SYSTEMS:

*Carlson Grade* was designed from the ground up to be structured for portability and easy expandability. The intensely organized code structure builds in product stability and enables enhancements without major re-writes or code overhaul. It is truly a product for the future. Carlson Grade will currently run on Windows (2000, XP, XP-Embedded, or Vista) and in the future, Linux.

# HARDWARE COMPONENTS

## Necessary Components & Overview:

*Carlson Grade* requires 3 hardware components, at a minimum. They include: base and rover GPS with associated antenna, radios at the base and rover to transmit the GPS corrections (or have an optional VRS or Reference Station network connection), and an onboard touch-screen computer to receive GPS positions (through serial or CAN port) and to run the Carlson program.

**Control Panel, Base Station, Rover GNSS**

*Carlson Grade* is installed by a dealer network associated with Carlson Software. We recommend the use of "kits" containing the software, computer, and ruggedized housing containing the GPS and radio.

## GPS & Radio (GPS Correction Radio):

GPS operation requires setup of the base GPS and the rover GPS. The setup procedures vary by GPS equipment. The typical procedure for GPS setup is to set the base GPS antenna on a point with a high elevation (top of building, silo, or a hill with power). Then use *Grade Supervisor* or a handheld data collector, such as *Carlson SurvCE*, to configure the base. This process identifies the correct antenna type, sets the antenna height and elevation mask, sets the radio type and port, sets the message string type (e.g. CMR, CMR+, RTCM, etc.), reads or identifies the base position and tells the GPS receiver it is to perform as a base and broadcast GPS corrections.

**Other Examples of supported GPS / Radio Receivers**

At that point, a rover localization is conducted (discussed under "System Setup & Configuration" section). After you configure and localize the base, daily operation can proceed without having to reconfigure. The antenna for the base GPS must remain at the same position for operation, or else you will have to reconfigure the base.

*Carlson Grade* is then connected, usually by a serial cable, to the rover GPS receiver on the equipment, which receives the base position by radio link and outputs the corrected rover position. GPS receivers normally communicate with a proprietary message stream that optimizes things like update rate (e.g. 1 Hz, 5 Hz, 10 Hz, or 10 per second). For example, a Leica 500 GPS system can communicate from the base to the rover at 10 hertz, or a 10 per second rate, which is ideal for automatic, blade-control grading, especially on dozers. However, you can also mix GPS receivers by specifying the CMR message string within Carlson Grade. Using CMR, a Trimble base can communicate with a Leica, Topcon or other type of rover GPS. The only downside to this is if the base is a Topcon Legacy or older piece of equipment with a maximum 1 Hz update rate. In this case, the rover must conform to the lower rate. (A 1 Hz update is fine for rover pole, truck or ATV applications.) Both the Garmin 18 GPS (WAAS) and the 10 cm-accuracy Navcom Starfire system can work without a base.

## Radio Placement (GPS Correction):

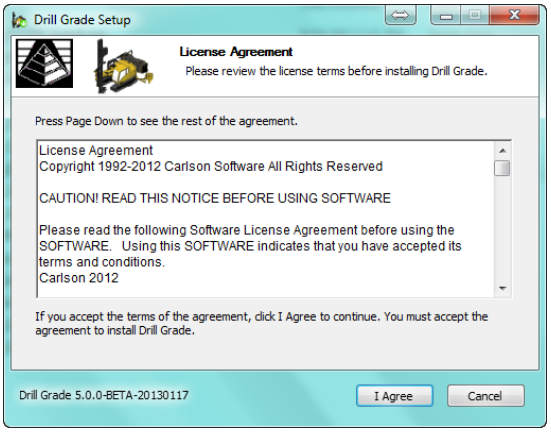
It is essential that the GPS corrections from the base GPS receiver be relayed out to the rover. At minimum, this requires a base radio and a rover radio. The base radio is usually mounted on top of a building, silo or other highpoint, as shown:

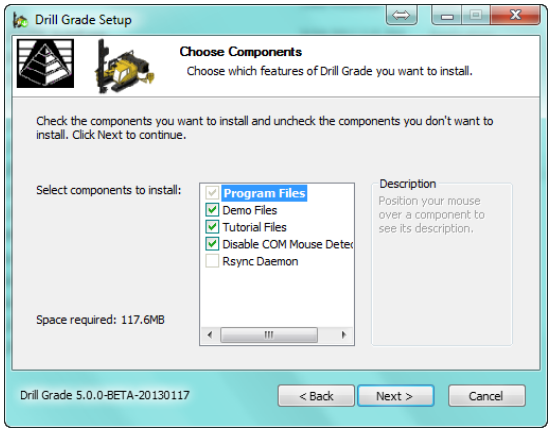
The rover radio is mounted on top of the equipment. Sometimes the radio signal from the base is too weak to be received on all rover equipment. In this case, it is necessary to add repeaters that pick up and re-transmit the signal. Repeaters are often placed at open view and elevated locations on the jobsite. Repeaters need power, so in remote locations like hilltops, solar repeaters are often used, as shown:

# Loading and Registering Carlson Drill Grade

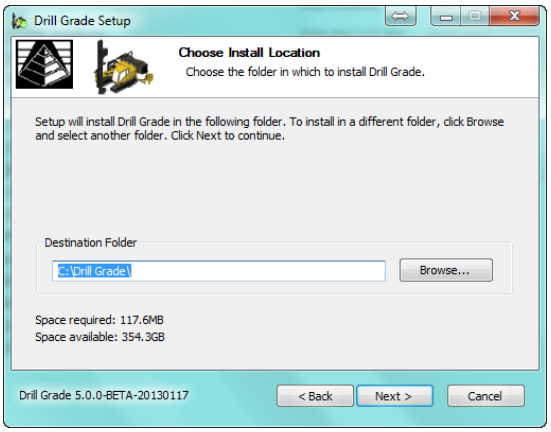
*Carlson Grade* can be installed from a PC card to a ruggedized field computer. Or from CD, PC card, USB card and the web to an office PC. A license agreement is presented which should be read. Click "I Agree" to continue.

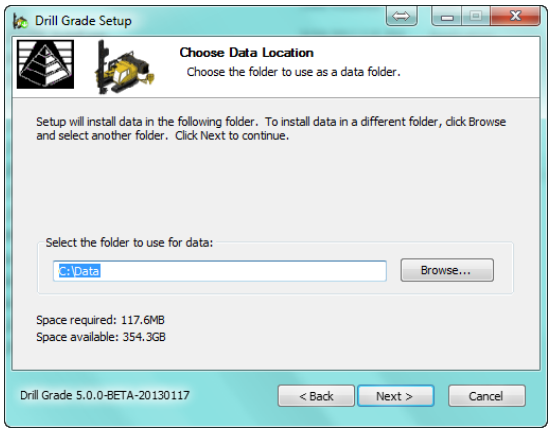
The next screen that appears shows the files to be installed, and confirms the size of the files in total (over 20 Mb). Then you are prompted for where to place *Carlson Grade*. For CBx5 Control Panels, choose (D:\Carlson Grade)


Drill Grade Setup
License Agreement
Please review the license terms before installing Drill Grade.
Press Page Down to see the rest of the agreement.
License Agreement
Copyright 1992-2012 Carlson Software All Rights Reserved
CAUTION! READ THIS NOTICE BEFORE USING SOFTWARE
Please read the following Software License Agreement before using the SOFTWARE. Using this SOFTWARE indicates that you have accepted its terms and conditions.
Carlson 2012
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Drill Grade.
Drill Grade 5.0.0-BETA-20130117
I Agree
Cancel


Drill Grade Setup
Choose Components
Choose which features of Drill Grade you want to install.
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.
Select components to install:
Program Files
Demo Files
Tutorial Files
Disable COM Mouse Dete
Rsync Daemon
Description
Position your mouse over a component to see its description.
Space required: 117.6MB
Drill Grade 5.0.0-BETA-20130117
< Back
Next >
Cancel

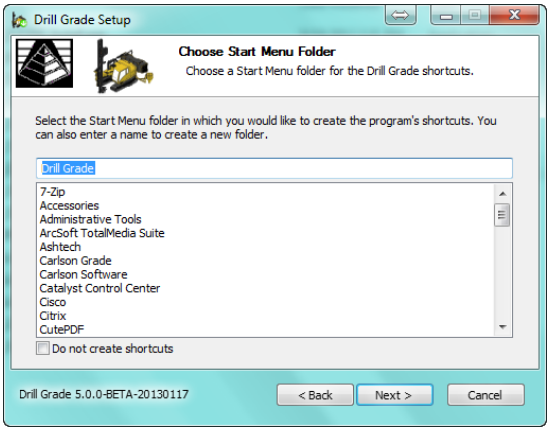
When installing onto CBx5 control panel, it is important to use the data directory (D:\Data) for all data files. Although you can select other directories, choosing the default greatly reduces technical support and troubleshooting issues.
You are then prompted about shortcuts and whether you want to load *Carlson Grade* automatically or not. For field installs, it is highly recommended to click on "Start Carlson Grade on Startup".

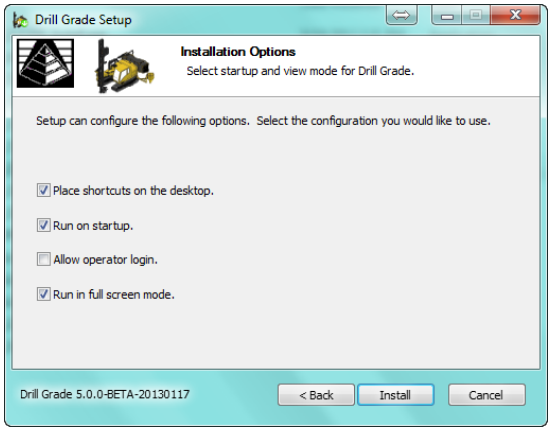

Drill Grade Setup
Choose Install Location
Choose the folder in which to install Drill Grade.
Setup will install Drill Grade in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.
Destination Folder
C:\Drill Grade\
Browse...
Space required: 117.6MB
Space available: 354.3GB
Drill Grade 5.0.0-BETA-20130117
< Back
Next >
Cancel


Drill Grade Setup
Choose Data Location
Choose the folder to use as a data folder.
Setup will install data in the following folder. To install data in a different folder, click Browse and select another folder. Click Next to continue.
Select the folder to use for data:
C:\Data
Browse...
Space required: 117.6MB
Space available: 354.3GB
Drill Grade 5.0.0-BETA-20130117
< Back
Next >
Cancel

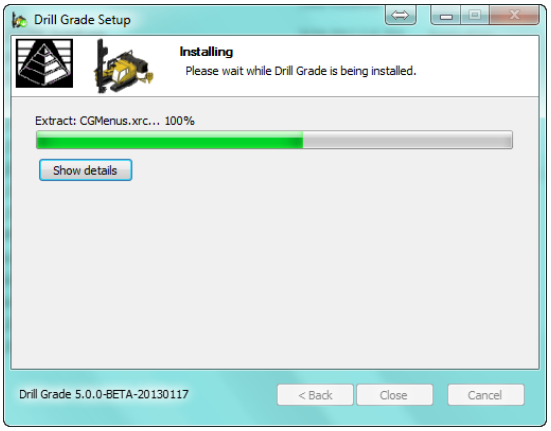
You are then prompted to run in full screen mode. It is recommended, for field use that you leave the default on. However, if installing on an office PC for training purposes you can uncheck this option and there access other windows on your personal computer.

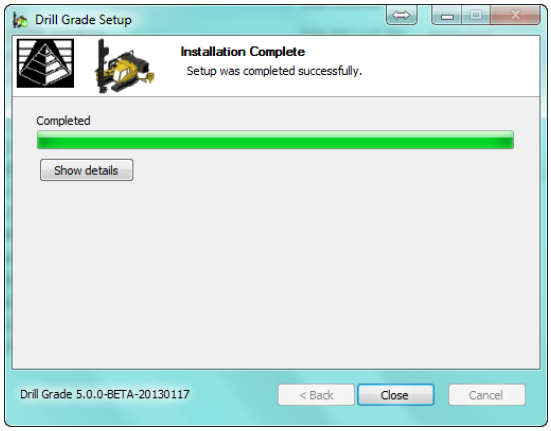
When you select “Install”, the program will run as you see here (see aside). When this completes, the close button on the lower right will no longer be ghosted.





Drill Grade Setup
Installation Options
Select startup and view mode for Drill Grade.
Setup can configure the following options. Select the configuration you would like to use.
Place shortcuts on the desktop.
Run on startup.
Allow operator login.
Run in full screen mode.
Drill Grade 5.0.0-BETA-20130117
< Back
Install
Cancel

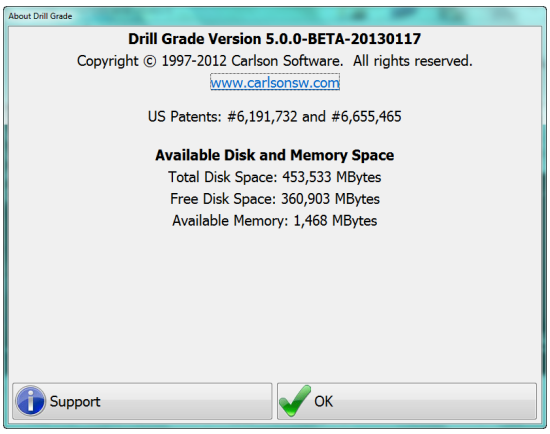
*Carlson Grade* installs itself on the hard drive. This process may take a few minutes depending on the speed of the computer. If no prior UOA of *Carlson Grade* is detected you will be prompted for one to activate the install in the initial setup of the software. The installer can setup the GPS, the initial toolbar placement, visibility options, vehicle type and settings, logging options, and optional hardware.

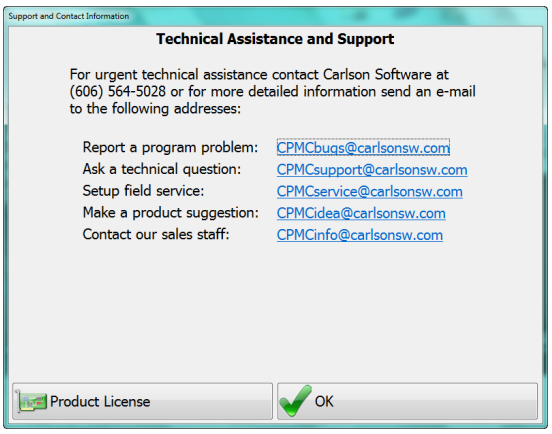



**Product Registration:**

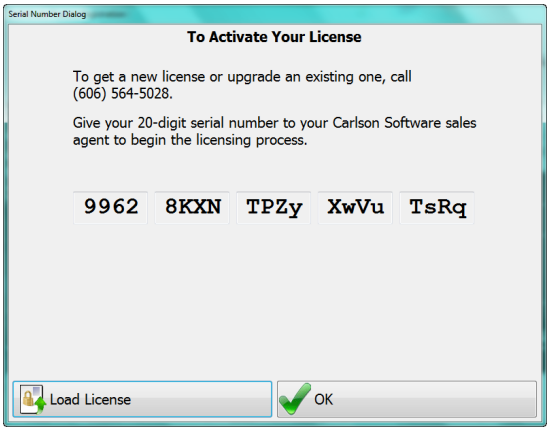
*Carlson Grade* will run on a temporary UOA file for 30 days before disabling communication through the serial ports. If you are registering, press the “About Carlson Grade” button to continue. If you are running the software as a demo, you do not need to do these steps. Next, press the “Support” button to continue.

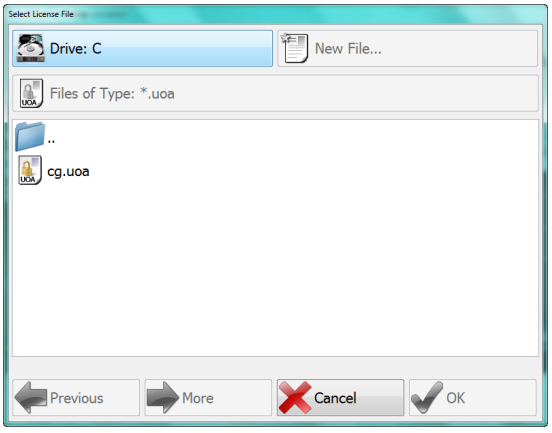




Support and Contact Information
Technical Assistance and Support
For urgent technical assistance contact Carlson Software at (606) 564-5028 or for more detailed information send an e-mail to the following addresses:
Report a program problem: CPMCbugs@carlsonsw.com
Ask a technical question: CPMCsupport@carlsonsw.com
Setup field service: CPMCservice@carlsonsw.com
Make a product suggestion: CPMCidea@carlsonsw.com
Contact our sales staff: CPMCinfo@carlsonsw.com
Product License
OK

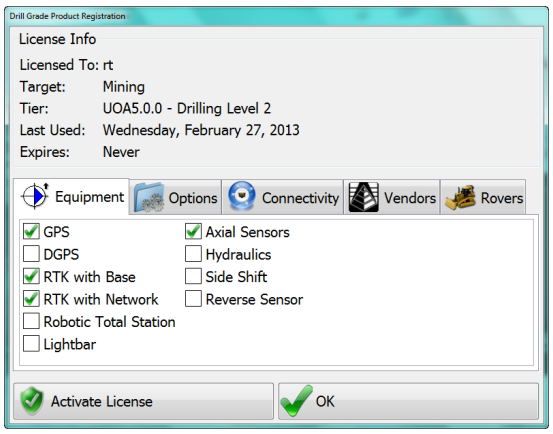
Once you have selected the "Support" button you will see the available support options. To register or check your available options, select the "Product License" button.
You will now see the following Information:
*Licensed To:* "company name"
*Target:* Construction, Mining, Landfill
*Last Used:* date
*Expires:* date software disables
*Enabled Product checklist:* all current equipment, options, etc. you have purchased.
If you are in demo mode and are running a UOA file that will expire, you need to select "Activate License" to proceed.

Contact your *Carlson Grade* Dealer to get an UOA file (License) to activate the product. You will need to be prepared to give the Serial Number found in the license screen shown to your right (underneath "To Activate Your License").
Once you have given this information to the Carlson dealer, they will send you a UOA file which will need to be loaded into the PC via a USB thumb drive. Press 'Load License' from the previous screen and select the 'Drive' that contains the Authorization Code (UOA) needed to license your product. Next, press OK and Grade will be activated.


Serial Number Dialog
To Activate Your License
To get a new license or upgrade an existing one, call (606) 564-5028.
Give your 20-digit serial number to your Carlson Software sales agent to begin the licensing process.
9962 8KXN TPZy XwVu TsRq
Load License
OK




The Product support options you have purchased will have the boxes checked after the UOA is loaded as shown.




## Re-Installation:

The old version should be uninstalled using the Add/Remove Programs under Control Panel. Some of the files that are not uninstalled automatically (as shown in the example image below) are user and vehicle configuration files. Consequently, the necessity of reconfiguring each vehicle is avoided. Unfortunately, if new items are added to the configuration files, the configurations will need to be regenerated from scratch. Currently, the best way to regenerate configuration files is to make a backup of the configuration files and copy and paste the needed pieces into the newly generated vehicle configuration file.

All files are located in the directory c:\

| File Descriptions | Location | Name |
|---|---|---|
| Driver Config Files | \carlson grade\drivers | *.CFG |
| Application Settings | \carlson grade\program | *.INI |
| Error Log | \carlson grade\program | *.LOG |
| Login file | \carlson grade\program | *.LOG |
| Vehicle Config Files | \data\config | *.VDF |
| Event Log | \data\logs | *.TXT |

## Software Installation Tips:

One tool that is recommended is a USB memory stick. Load the installation file and the toolkit on it so you can easily use them on the Control Panel. You can use the tools from the USB key without installing them on the Control Panel.

## FILES AND FORMATS USED IN CARLSON GRADE

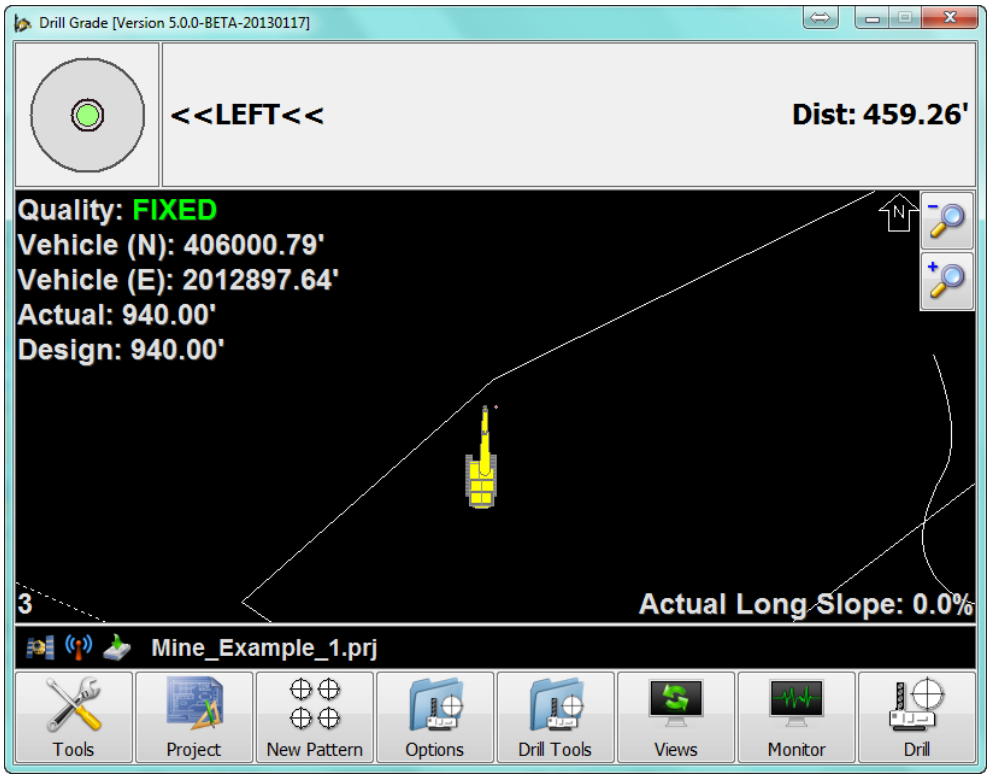
Carlson Grade uses certain files to display graphics and determine cuts and fills. In most cases, files include: the Plan View, the Design Surface DTM and the Localization file (.loc). DTM stands for "digital terrain model". Technically, the Design Surface DTM is optional since operators can check Cut/ Fills to an entered, flat elevation.
The various files are loaded into Carlson Grade on specific, recommended directories on the Control Panel. Files are loaded into these directories a couple of different ways. Manually selecting files in Carlson Grade from memory sticks, (USB drives, Thumb drives, etc.) or using Windows Explorer to copy files. Plan View (DWG or PLN files) and Localization files (LOC files) go in the c:\data directory. The design DTM files go in the c:\data\design\ directory. The existing surface DTM files and all secondary DTM files go in the c:\data\actual\ subdirectory. All other files used by Carlson Grade for data and display (e.g. centerline files, coordinate files, project files) go in the c:\data\ directory.

Plan View:
.ln3 (a plan view file with file extension ln3)
.dwg (a plan view file with file extension dwg)
.dxf (a plan view file with file extension dxf)
.pln (a plan view file with file extension pln)
Design Files:
.tn3 (a design file with file extension tn3)
.dwg (3d faces) (a design file with file extension dwg)
.dxf (3d faces) (a design file with file extension dxf)
.grd (a design file with file extension grd)
.tin (a design file with file extension tin)
.flt (a design file with file extension flt)
.dtm (a design file with file extension dtm)
.ntr (a design file with file extension ntr)
.gpt (a design file with file extension gpt)
Existing files:
.grd (an existing file with file extension grd)
Centerline files:
.cl (a centerline file with file extension cl)
Localization:
.loc (localization file with file extension loc)
.dat (localization file with file extension dat)
.gc3 (localization file with file extension gc3)
.udp (localization file with file extension udp)
.txt (localization file with file extension txt)
Coordinates:
.crd (coordinate file with file extension crd)
.txt (coordinate file with file extension txt)
.gpt (coordinate file with file extension gpt
Geoid:
.gsf (geoid file with file extension gsf

## OPERATOR INTERFACE

Carlson Grade starts right up into what is called the “Main Screen”. This is a different approach then many menu driven machine control programs. The idea behind this setup is ease of use for the operator. Since this is the first screen shown after boot-up, it allows the operator to begin working immediately. The screen is designed for a simple interface, allowing only a limited number of options for the operator, and reserving more complex setup procedures for “Advanced Tools”, accessible only by approved personnel. The Main Grading Screen is as shown.

The views shown are “Plan View” in the Navigation Feature along with the Level Vial (top left)

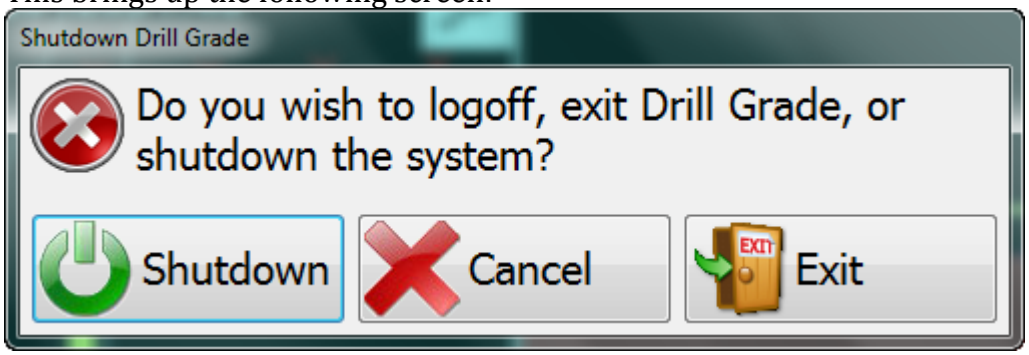


**Starting and Exiting Drill Grade:**
The first procedure to master is how to start and stop (enter and exit) Drill Grade. At present, Drill Grade is installed to start when the computer is turned on, but can be exited at-will by the operator. If the program has been exited without shutdown, the desktop may be visible to the operator. If this is the case, to restart Drill Grade, either double click the Drill Grade icon or select Drill Grade from the "Start Menu". If this is an office computer, it is not recommended to have Drill Grade start on boot-up. Future vehicle installations can optionally be tied into the vehicle power system to facilitate automatic power-up and power-down of Drill Grade with the vehicle.
When Drill Grade starts up, if "Operator Login" was specified during the install, you would obtain a log-in screen before going to the "Main Screen".

You must enter an Employee ID to continue and press OK. An added benefit of the operator login is that the operator-specific settings are saved. For example, if John Doe usually works night shift, he may have set his color scheme to cut down on brightness. This would prevent John Doe from needing to change from daytime to nighttime settings all the time.

The procedure to exit is: Tools/Exit or Shutdown

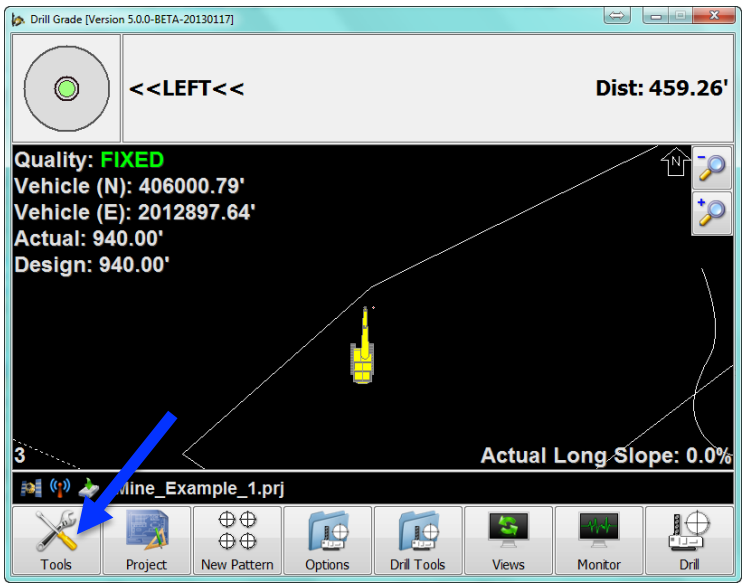
This brings up the following screen:



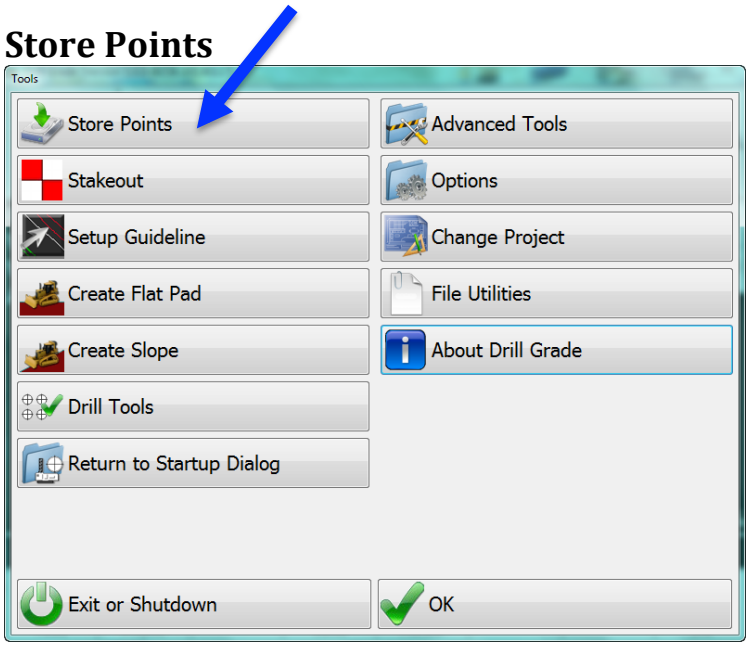

Shutdown will turn the computer off. Exit will exit to Windows. If you logged in, the Logoff option lets another operator select his name while the program is running. Operator names are used for productivity analysis and general reporting.

## Tools Menu

Tools menu contains special functions and features of Carlson Grade program. The area of Advanced Tools inside the Tools menu is area to configure rover (GPS) settings, input machine or vehicle measurements, and setup other options and values for the particular application.

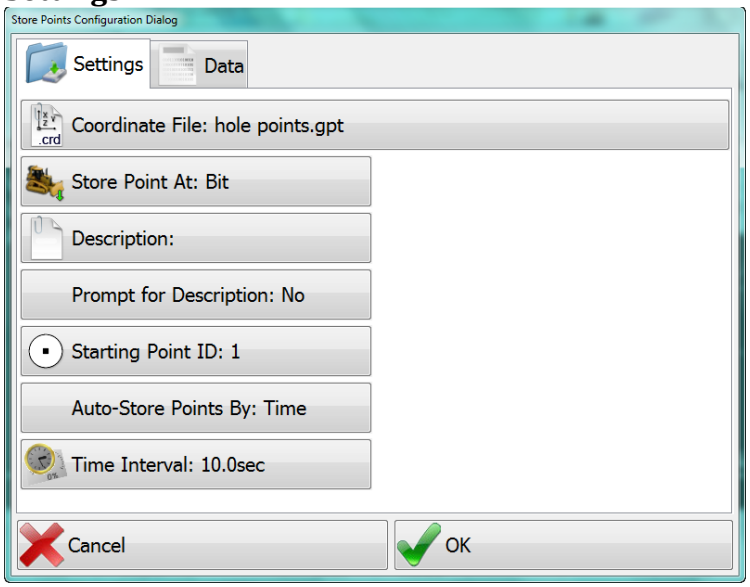



## Store Points



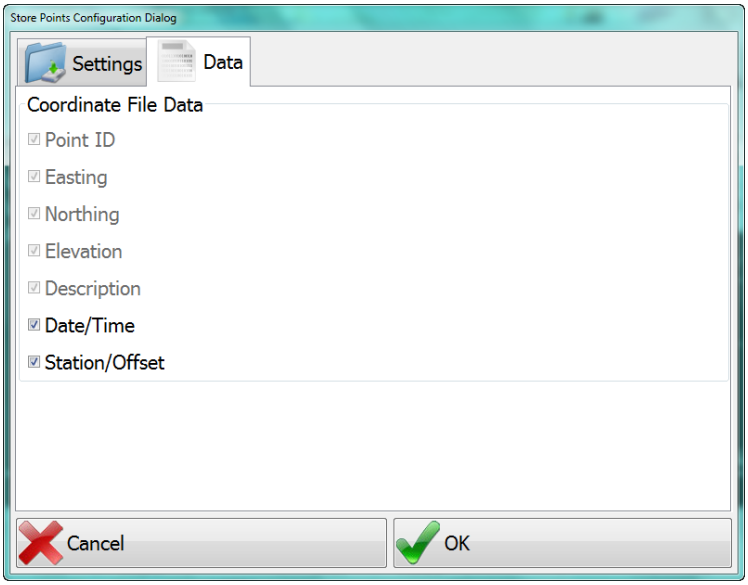

The Store Points button brings up the Store point Configuration Dialog. Here you will select or create filename, location to store point, auto-store settings, etc. Details for each setting are described below.

## Settings




1. Coordinate File:
   - ⇒ Press the Coordinate File button to choose from existing list of files or to create a new coordinate filename to store points to. Once you have created a new filename if this is what you choose to do, the filename will be available next time you press the Coordinate File button to choose from list of filenames.
2. Store Point At:
   - ⇒ Cycle through available options by pressing the Store Point At: button. In programs such as Drill Grade, the only available option may only be "Bit" or "Collar"
3. Description:
   - ⇒ Enter a description that will be attached to each stored point. The description will remain in each of future stored points within the current filename until the description is changed or a new file is loaded or created. For example, "Ground Shots" is a common description when collecting a topo survey of an existing terrain. (surface)
4. Prompt for Description:
   - ⇒ Set this to yes if you would like to be prompted for a new description each time a point is stored.
5. Starting Point:
   - ⇒ Enter the starting point number you would like to see when storing the first point of the file.
6. Auto-Store Points By:
   - ⇒ Time:
     - Enter the time by seconds you wish to capture (store) points when auto-store is enabled from the main Store Points screen.
   - ⇒ Distance:
     - Enter the distance you wish to capture (store) points when auto-store is enabled from the main Store Points screen.

## Data

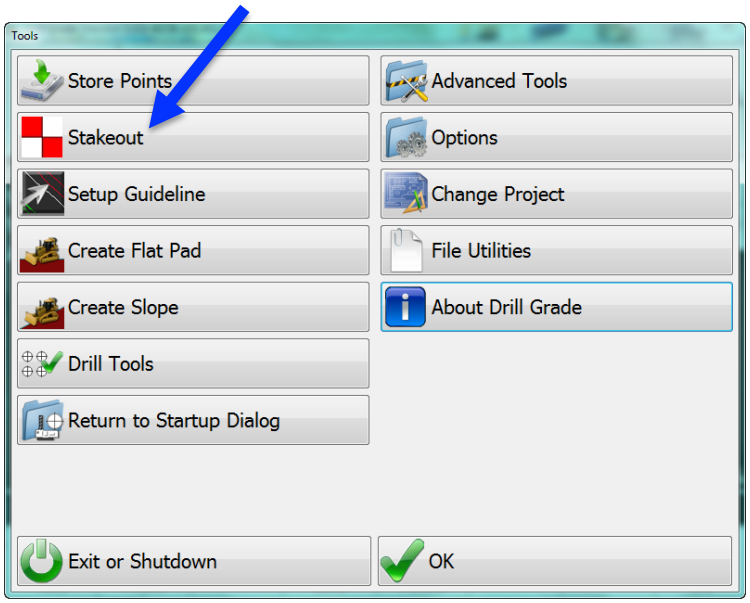


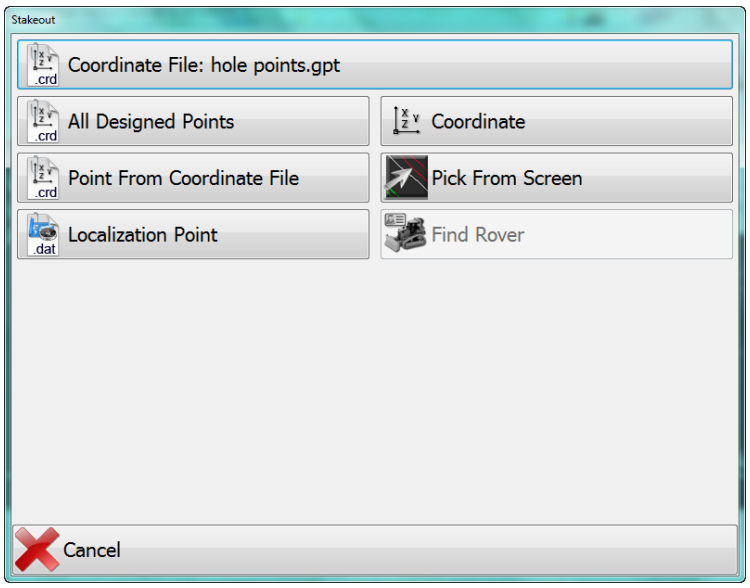

Data describes what information is present in each stored point. Optional data that can be attached to the end of each point are selectable with check marks. Default information that cannot be changed or edited are:
Point ID, Easting, Northing, Elevation, Decription,…

Additional information that can be attached to the end of each point include

1. Date/Time
   ⇒ The Date and Time of each stored point
2. Station/Offset
   ⇒ Station number and offset of each stored point

## Stakeout

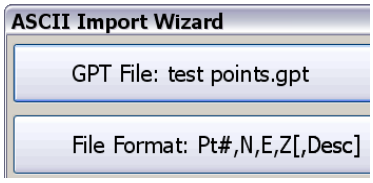


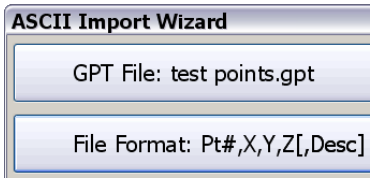



**1.** Coordinate File

⇒ Load Coordinate File

- If loading a .txt (text) file, you will be asked to confirm the format of the text file before converting to a Carlson .gpt file (grade point file)
- Highlight the text (.txt) file you wish to load and press OK.
  - Pick the method of conversion you wish to use in the ASCII Import Wizard:




  - Press OK and your text (.txt) file will be converted to a .gpt file and loaded into Carlson Grade.

⇒ All Design Points

- Main screen with all points loaded from file visible for selection

⇒ Point from Coordinate File

- Select point from Coordinate file list

⇒ Localization Point

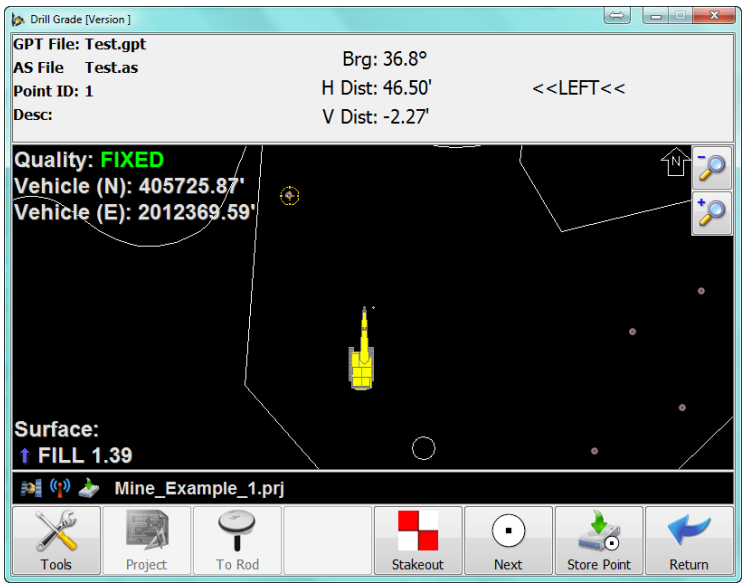
- Select Localization point from .loc file from list

⇒ Coordinate

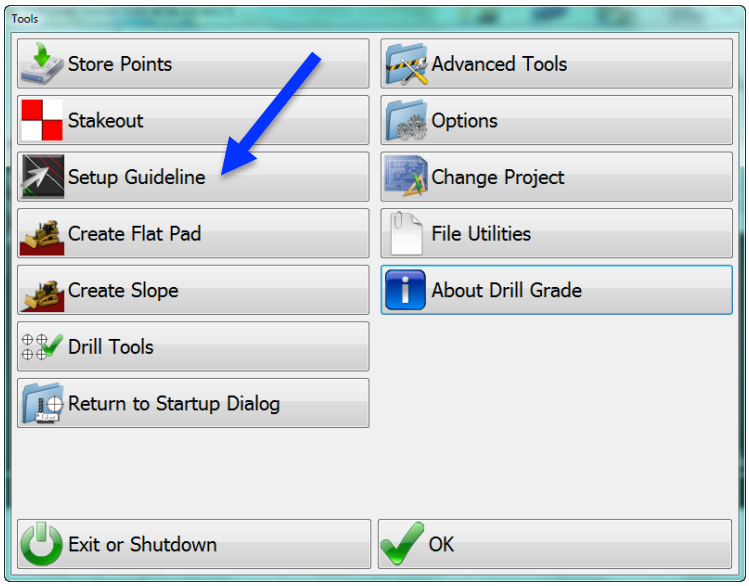
- Enter Coordinate manually to stakeout

⇒ Find Rover (if applicable)

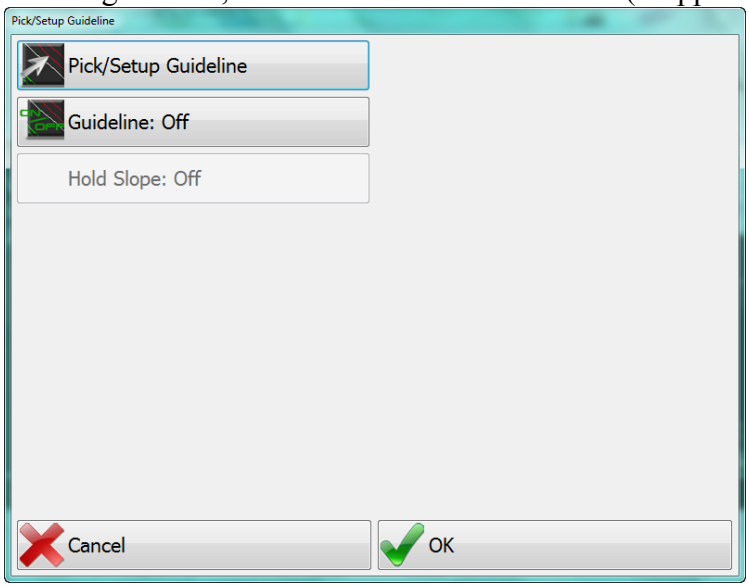
- Guides you to other rovers that are working on same network configuration. (will require heartbeat to be enabled)




## Setup Guideline



1. **Pick/Setup Guideline**: Selecting a Guideline will display steering directions, distance from chosen guideline, and station/offset information (if applicable)




⇒ Select the guideline graphically from the screen, you will need to access the setup screen for left, right, or center indication and possible offset.

⇒ **Offset to Guideline:** Enter a number, in decimal feet, into the box that states "Offset to Guideline" for the offset to the selected line. (NOTE: There is no sure way to identify how the polyline was vectored. Typically positive indicates offset right and negative indicates left. To verify if your value is correct, return to the main screen. After that, see if the value of your offset is opposite to your desired value. If it is, return to the "Guideline Setup" screen or not and change the sign of your offset.)

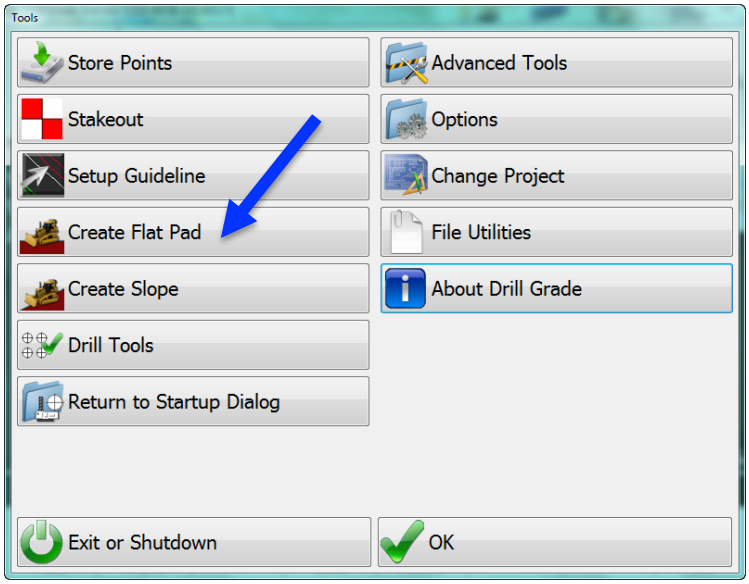
⇒ **Steering Edge:** (Left, right, or center) this is perceived from the operators view. If the line you intend to follow is on your right then typically you would want to measure from the right edge of blade.

⇒ When finished with the setup, select OK and then ACCEPT. You will see this screen with a hashed line from the vehicle steering edge to the guideline. In the status bar

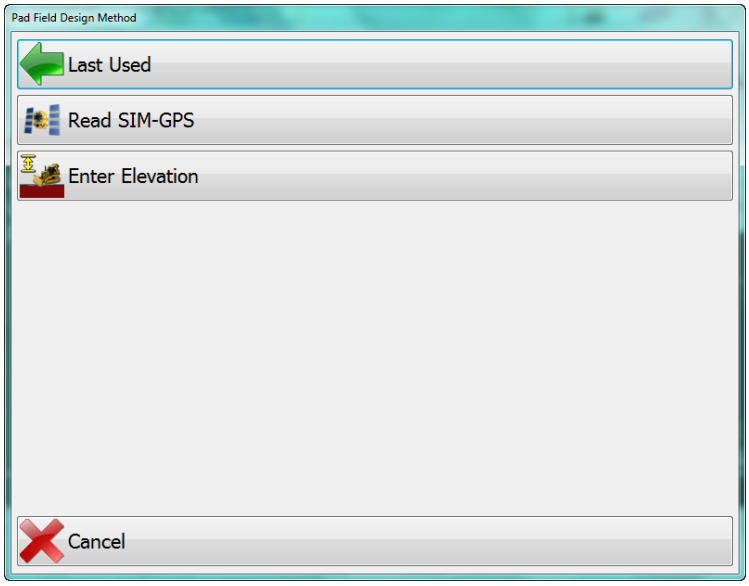
you will see station and offset information that you can use to follow. If using a CL file, the stationing will be derived from the CL file; however if you are using a graphical guideline, the station is based on the beginning on the line. (To end the guideline routine, select Tools and then Guideline: off)

2. **Guideline ON / OFF:**
   a) Controls whether or not the offset will be drawn in the plan view. It will show a dashed white line with a red circle at the end from the vehicle to the position of interest, if it is set to "Yes".
3. **Hold Slope**
   a) Locks current slope at vehicle position. Slope commitment will stay in this state until turned off in Guideline setup.

## Create Flat Pad

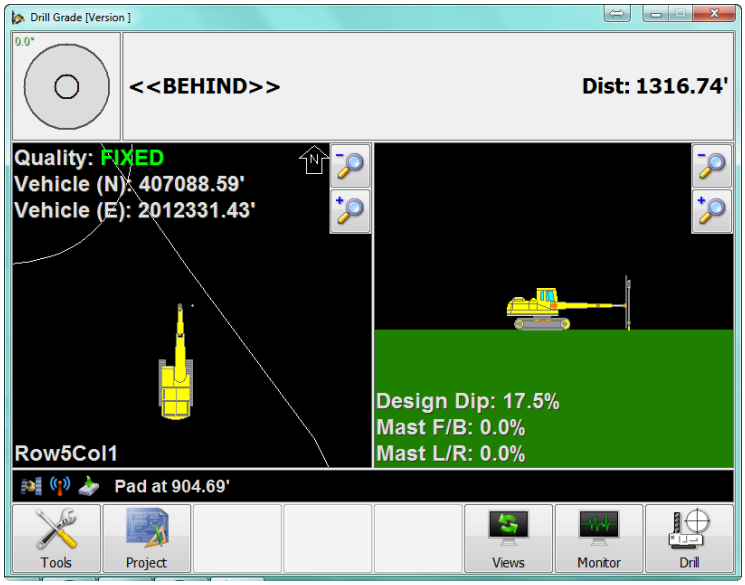



**Create Flat Pad:** This feature is used to create a flat surface that extends throughout entire plan view file. This is a quick and simple way to hold consistent elevation for temporary task or a day by day scenario. There is ability to enter an elevation you wish to hold or choose to "Read GPS" for a benchmark from the vehicles track elevation.

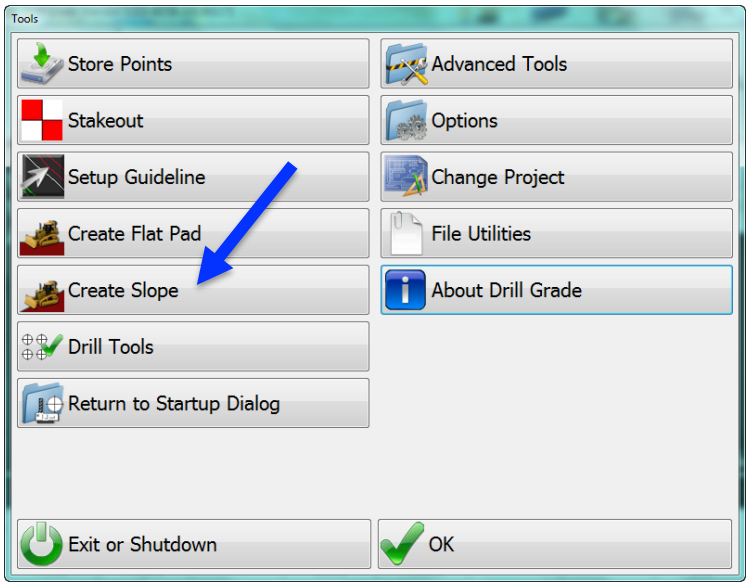



1. Last Used
   ⇒ Loads last used flat pad elevation
2. Read GPS
   ⇒ Reads GPS position at current vehicle location and sets elevation for flat pad
3. Enter Elevation
   ⇒ Enter in elevation value to use for flat pad

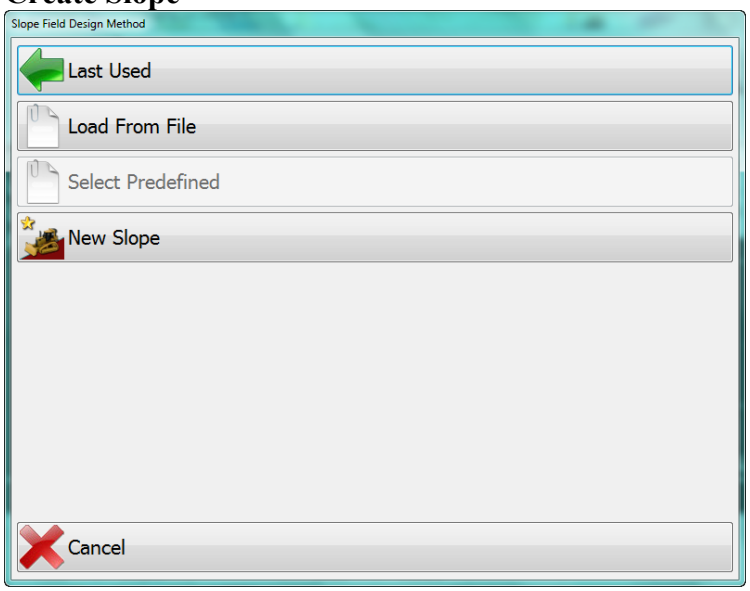
⇒ Flat pad is displayed as Green surface to differentiate between flat pad and design surface.



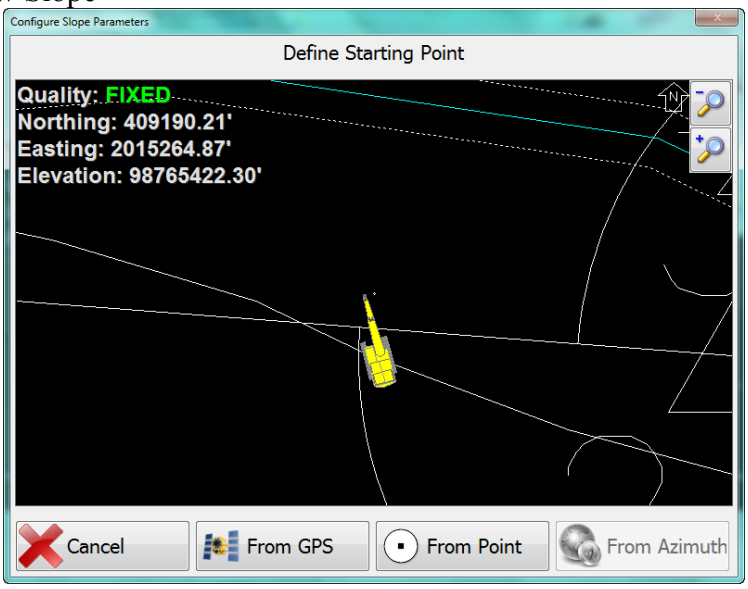
**Create Slope:** Create Slope is feature for creating a user defined multiple, compound slope based off of a defined centerline or 3D polyline. For example, you have the ability to create and design a cross section to look something like image below. You can extend this profile or "road" to the total length you wish.




**Create Slope**



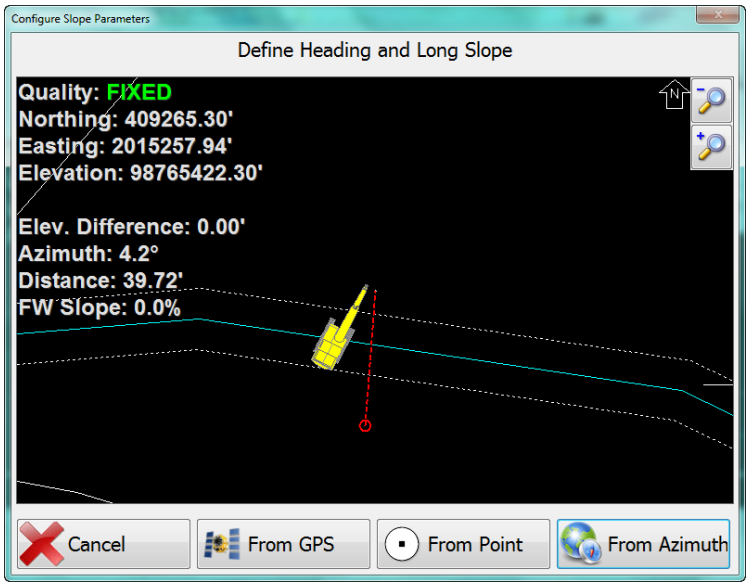
1. Last Used
   ⇒ Loads last used slope
2. Load from File
   ⇒ Select slope file (.slp) from Data/Design directory to load as current slope design.
3. New Slope




⇒ Move to position to define slope starting point.
- From GPS:
  * Record current GPS position and set as starting point for slope design. (point A)
- From Point:
  * Pick coordinate from list (from current coordinate file loaded)
  * Enter coordinate manually

⇒ Move to 2nd position to define heading and forward slope of slope design. Or if heading is known, enter Azimuth for slope design.

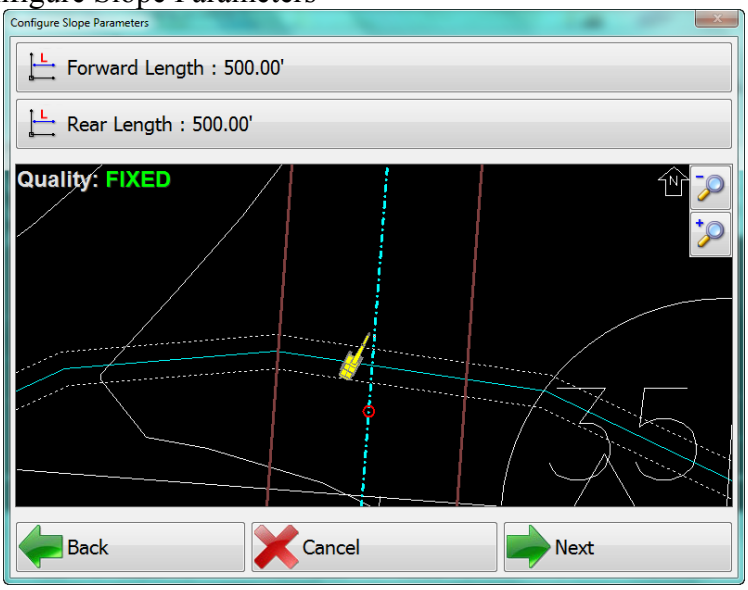
⇒




⇒

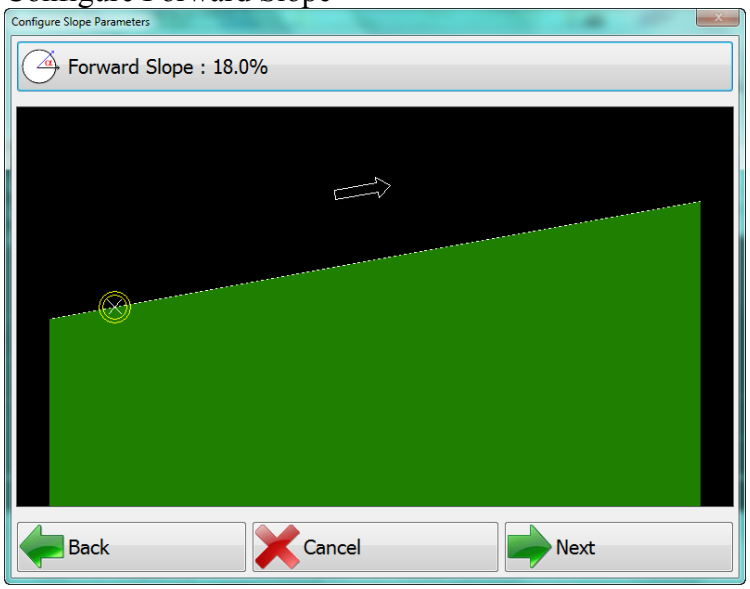
- From GPS:
  - Record current GPS position and set as starting point for slope design. (point A)
- From Point:
  - Pick coordinate from list (from current coordinate file loaded)
  - Enter coordinate manually
- From Azimuth:
  - Enter Azimuth for heading definition

⇒ Configure Slope Parameters



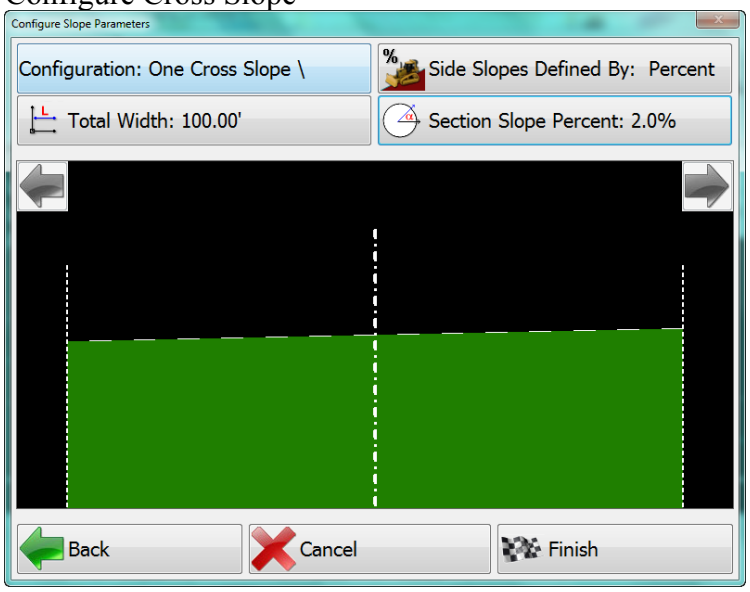

- Forward Length:
  - Enter the forward length of slope design from starting point. This is length that slope extends forward from point A.
- Rear Length:
  - Enter the rear length of slope design from starting point. This is length that slope extends backward from point A.

⇒ Configure Forward Slope




- Forward Slope is calculated between the starting point and second point. (from point A to B)
- Forward Slope can be edited by pressing the Forward Slope button with value.

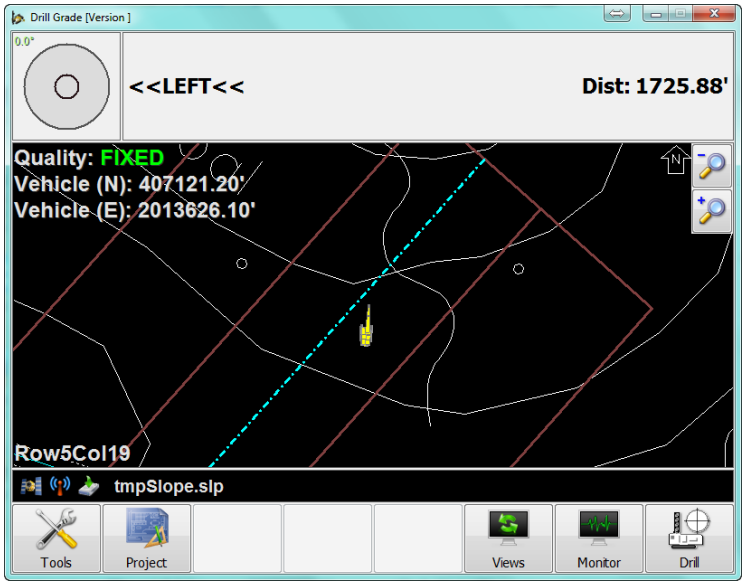
⇒ Configure Cross Slope



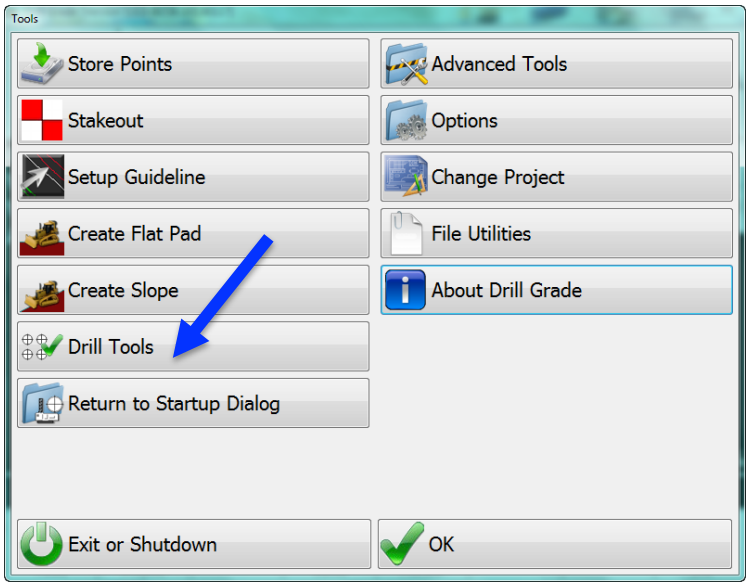

- Configuration:
  - Select between No Cross Slope, One, Two, Four, or Six Cross Slopes.
- Switch to and from cross section segments by pressing the on-screen arrows left and right.
- Side Slopes Defined By:
  - Percent %
  - Ratio
- Total Width
  - Enter Width on cross slope sections as highlighted on screen

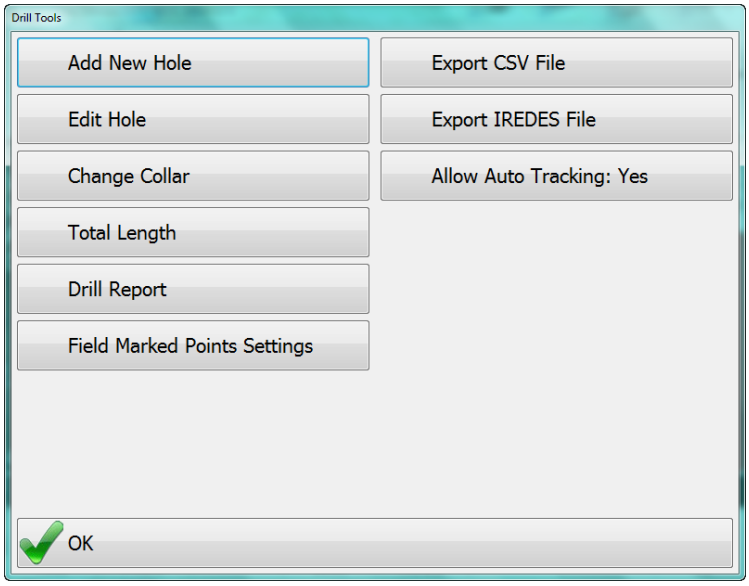
- Section Slope Percent/Ratio
  - Enter slope value for each section

⇒ Finish

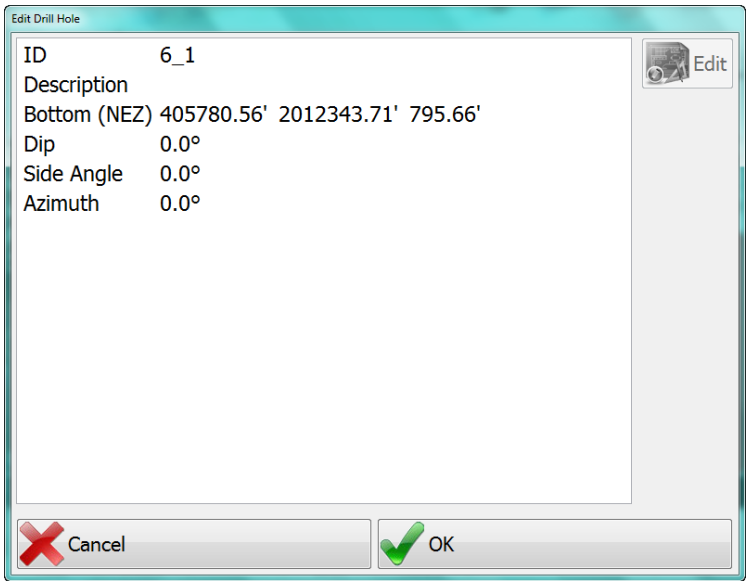


**Drill Tools:** This menu allows you to Add new holes to an existing hole pattern, give information such as total length drilled and number of holes drilled, and also export drill data as IREDES format or simple csv format (comma separated values)
Information on each button and feature are listed and described below.



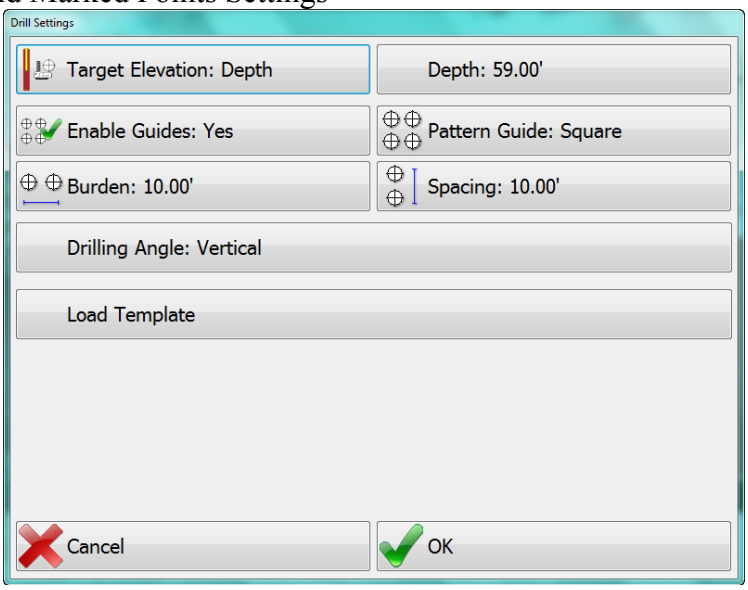
1. Add New Hole




   ⇒ Position Collar at desired new hole location. The hole at this position will be added into existing drill file.
      - Edit information about the new hole by highlighting the area you would like to change and press Edit at top right of page.
      - Change ID, Description, and/or azimuth for example
      - Press Ok to add new hole

2. Edit Hole
   ⇒ Edit information about the new hole by highlighting the area you would like to change and press Edit at top right of page.
   ⇒ Change ID, Description, and/or azimuth for example
3. Change Collar
   ⇒ Changes Collar position to current location from design target
4. Total Length
   ⇒ Total length drill has tracked since last reset. Ex 2300m
5. Drill Report
   ⇒ Basic Drill Report listing:
      - Total Length: Accumulative length of holes drilled
      - Holes Drilled: Total number of holes drilled since reset of counter
      - Min hole depth: Minimum Hole depth of all holes drilled
      - Max hole depth: Maximum Hole depth of all holes drilled
      - Avg time of drilling: Average time spent during each completion of drilled hole.

**6.** Field Marked Points Settings




⇒ Target Elevation
- Depth
  - ∗ Enter the desired depth of hole
- Elevation
  - ∗ Enter desired elevation for bottom of holes
- Design Surface
  - ∗ Enter a Vertical Offset if applicable. Leave Vertical Offset at 0.00' if desired bottom depth is to intersect at loaded surface design.
- Collar Only
  - ∗ Option uses the collar position to calculate depth in relation to design surface.

⇒ Enable Guides
- Turns On/Off guide display in main screen. This is a graphic circular guide around the machine to indicate defined distances. The guide size is determined by the Burden and Spacing values.

⇒ Pattern Guide
- Square: Square pattern
- Staggered: Staggered pattern

⇒ Burden
- Enter desired Burden distance

⇒ Spacing
- Enter desired Spacing distance

⇒ Drilling Angle
- The entered drilling angle will be used in all holes throughout pattern

⇒ Load Template
  - ∗ Load saved templates to be used in new pattern locations

**7.** Export CSV File

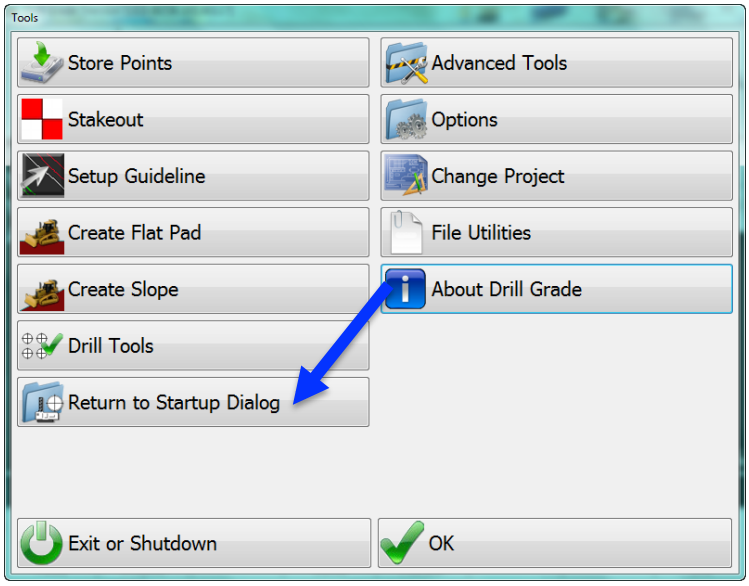
⇒ Exports drill file into easy to read .csv file.

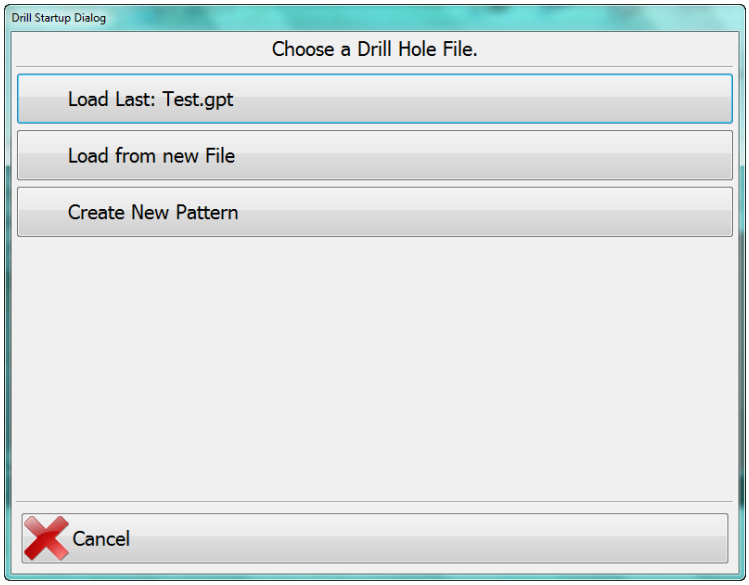
⇒ File can be opened in Excel

**8.** Export IREDES File
⇒ Exports the IREDES standard format to file
⇒ IREDES (International Rock Excavation Data Exchange Standard)

**9.** Allow Auto Tracking
⇒ Set Drill Vehicle to auto pick closest target while tramming.

**Drill Startup Dialog:** From this menu, you can choose to "Load" an existing Drill Hole file or Create a New Pattern for a file. Load an existing file by selecting "Load Last" or "Load from new File". Follow these steps to choose how you want to define the working (active) pattern.

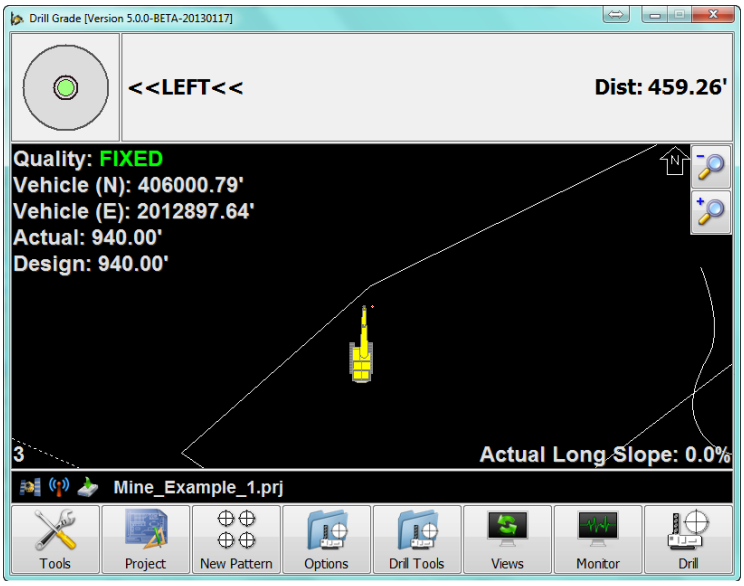



**1.** Load Last
⇒ Loads last used drill file as current

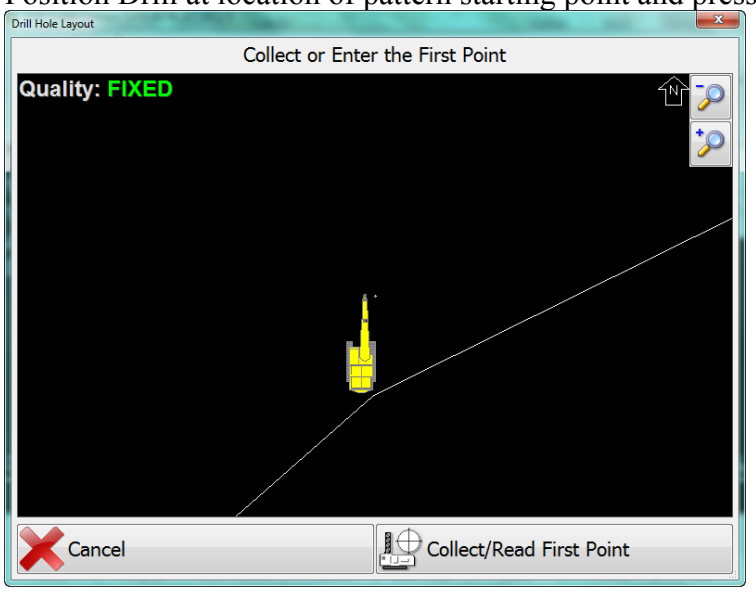
**2.** Load from new File
⇒ Select drill file from data directory to load as current

**3.** Create New Pattern




⇒ Select how you wish to define the starting coordinate or position on the new pattern.

⇒ Position Drill at location of pattern starting point and press "Collect/Read First Point"

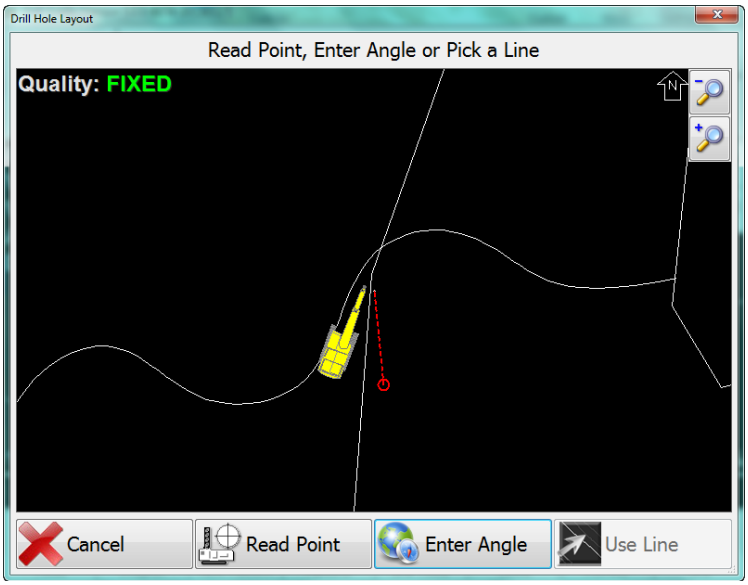



- A GPS position will be recorded and listed for confirmation. If correct, continue by pressing OK and proceed to 2nd position.

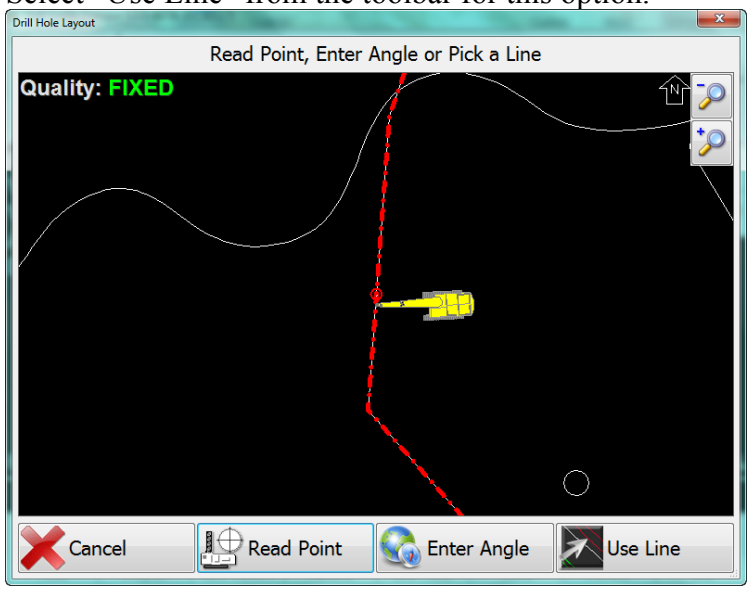
⇒ The 2nd position will record a GPS position by the Drill and calculate the heading, elevation difference, and slope.

- You can choose to omit this option and enter a known heading or azimuth if this information is available to you. Do this by pressing "Enter Angle" from the

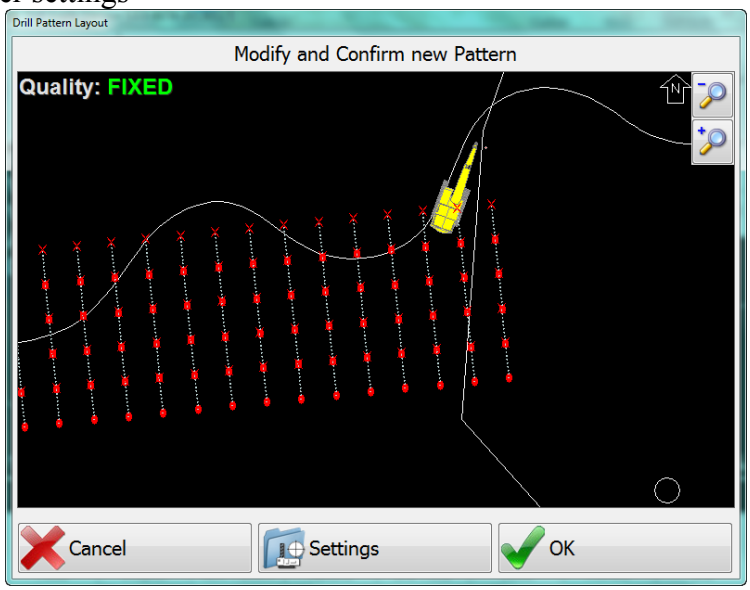
toolbar.



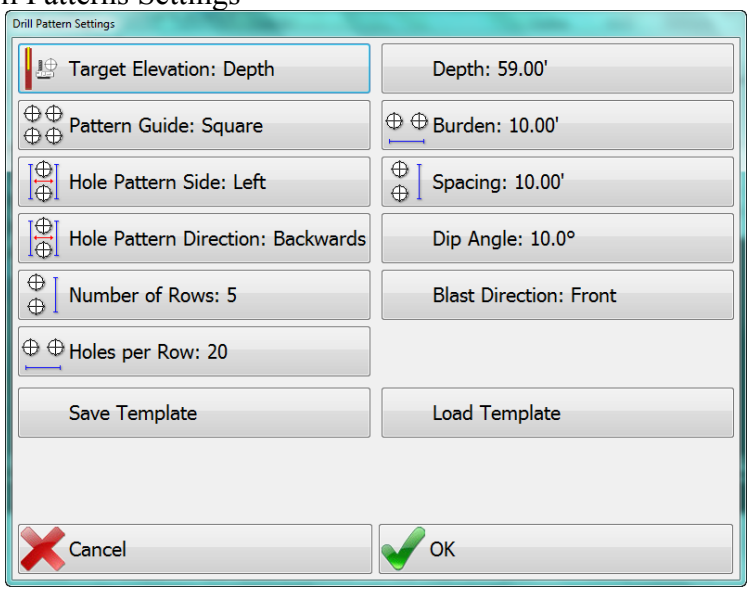

- There is also the option to use a polyline to direct heading/azimuth for the pattern. To use this option, highlight a polyline on the screen by clicking on it with your finger. The line will become highlighted with a hashed line for confirmation. Select "Use Line" from the toolbar for this option.



⇒ After these steps are taken, you have the opportunity to modify the pattern layout and other settings



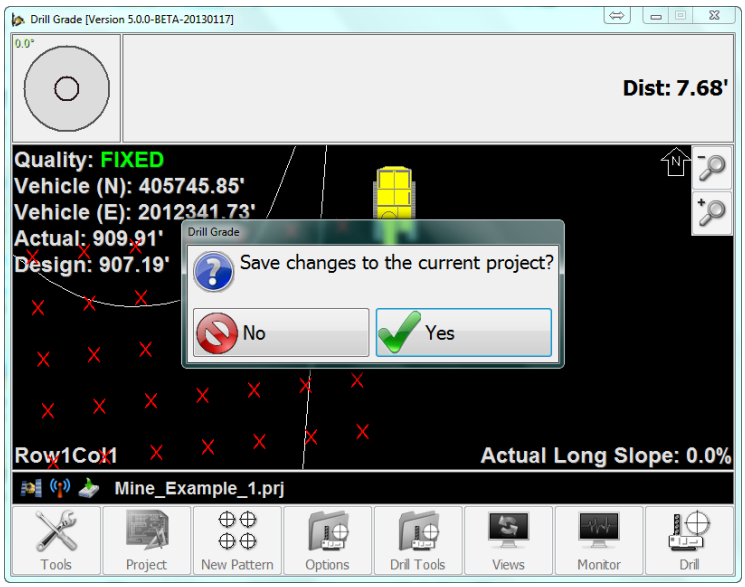

⇒ Drill Patterns Settings

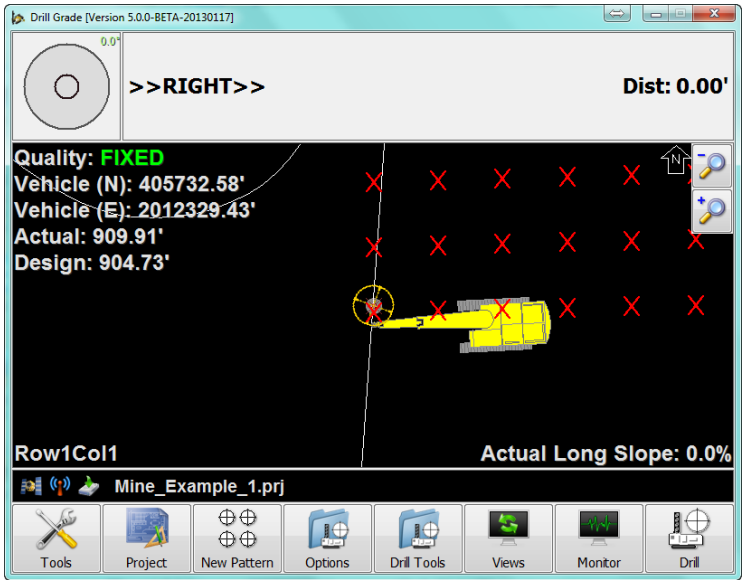



- Target Elevation
  - Depth
    - Enter the desired depth of hole
  - Elevation
    - Enter desired elevation for bottom of holes
  - Design Surface
    - Enter a Vertical Offset if applicable. Leave Vertical Offset at 0.00' if desired bottom depth is to intersect at loaded surface design.
  - Collar Only
    - Option uses the collar position to calculate depth in relation to design surface.

- Pattern Guide
  - Square
  - Staggered
- Burden
  - Enter desired Burden
- Spacing
  - Enter desired Spacing
- Hole Pattern Side
  - Left
  - Right
- Hole Pattern Direction
  - Forwards
  - Backwards
- Number of Rows
  - Enter the desired Number of Rows
- Holes per Row
  - Enter the desired number of Holes per Row
- Dip Angle
  - The entered dip angle will be used in all holes throughout the pattern.
- Blast Direction
  - Front
  - Back
  - Left
  - Right
- Save Template
  - Save the pattern template to be used again and again in different areas.
- Load Template
  - Load saved templates to be used in new pattern locations

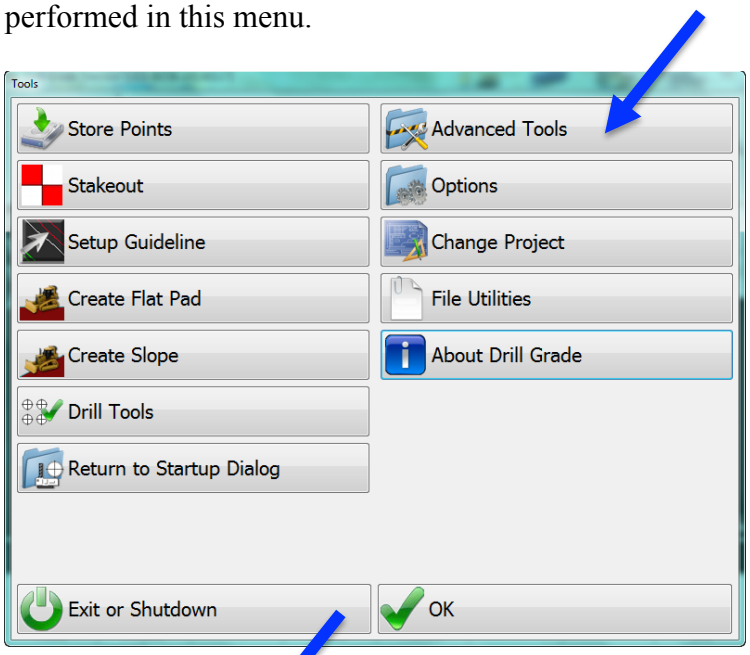
Once you have entered the pattern settings and configured the target location, press the OK button to load the designed drill pattern. The Drill Grade program will ask if you would like to save changes to the current project. Press Yes to continue.

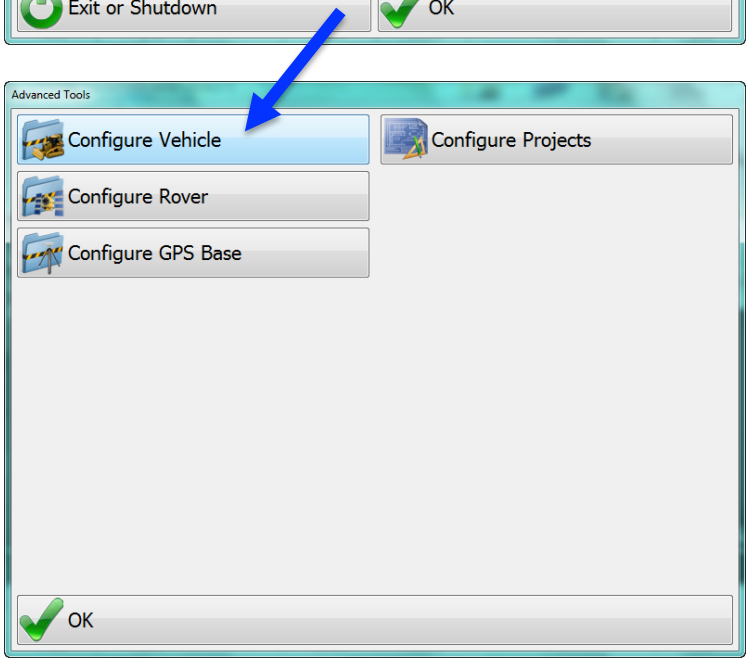


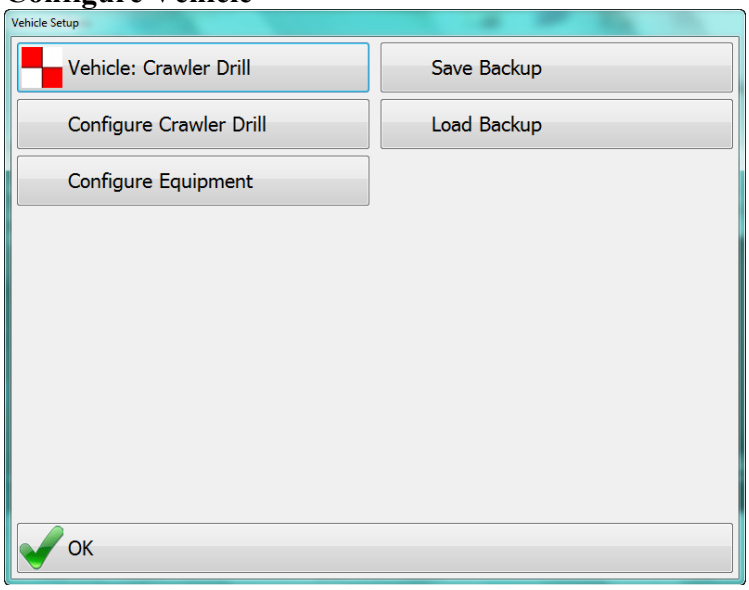

Navigate to the hole while viewing the direction indicators as shown above (>>Right>>) Indicators will display Right, Left, Forward, Behind for direction needed for collar position. The Distance (Dist:) will indicate how far from the collar position you are. Once you have reached a drilling tolerance, (set in Tools/Options/Navigate Options/Stakeout Tolerance) Note: If "Allow Auto Tracking" is enabled in Drill Tools, the drill target will automatically select the closet hole to the drill as you move.

**Advanced Tools:** This menu accessed mainly by installers and administrators. GNSS rover configuration along with Drill (vehicle) dimensions, offsets, and sensor configuration are performed in this menu.



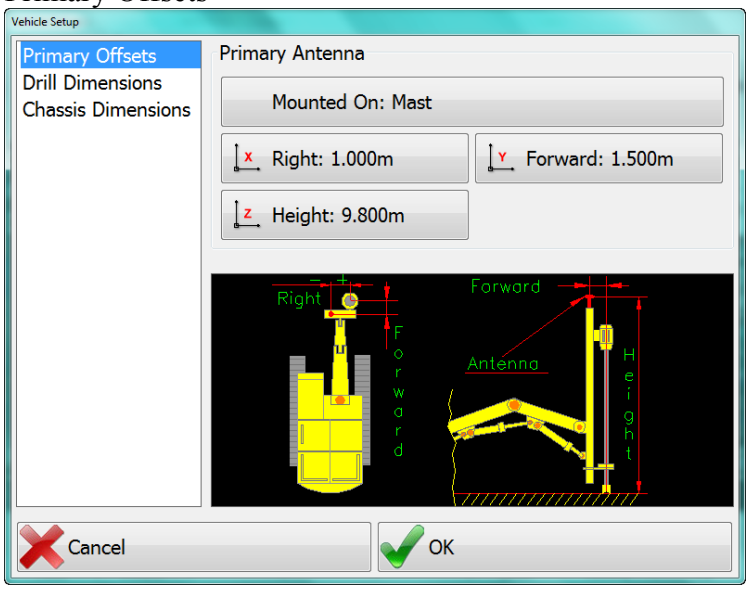



## 1. Configure Vehicle




a) Vehicle:
   ⇒ Vertical Drill (Platform Drill)
   ⇒ Crawler Drill (Rock Drill)
   ⇒ Simple Drill (Navigation to hole only. No depth monitoring)

b) Configure Drill
   ⇒ Primary Offsets

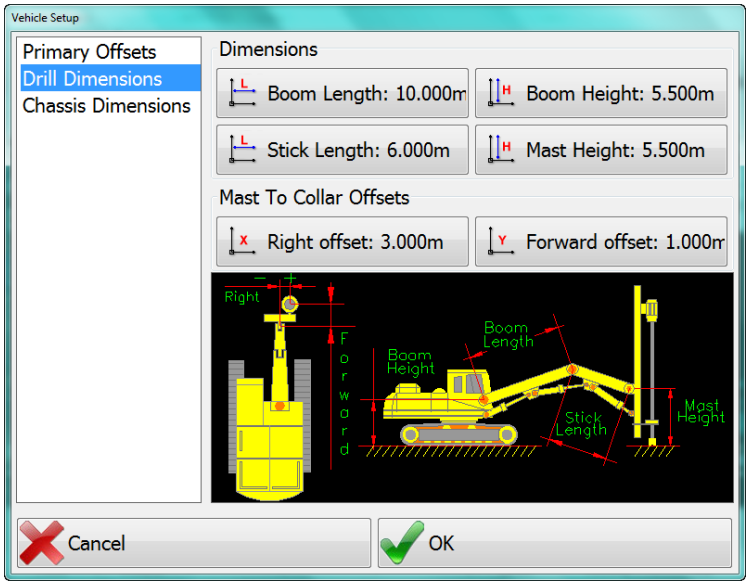



- Mounted On:
  * Mast: GPS RTK position antenna mounted on Mast (Feeder)
  * Body: GPS RTK position antenna mounted on Body (Platform)
- Right:
  * Horizontal Left/Right distance from Collar. (Drill Bit) (Antenna left of Collar would be a negative value. Ex. -0.24m (-0.79 ft)
- Forward:

- Horizontal Forward/Backward distance from Collar (Drill Bit). (Antenna behind Collar is a negative value. Ex. -0.10m (-0.33 ft)

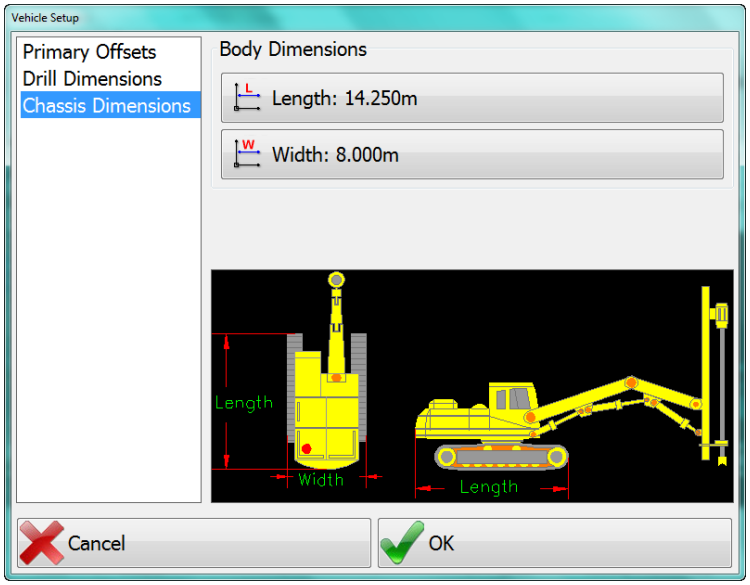
- Height:
  - Antenna height above retracted Collar position (retracted drill bit) Ex. 9.2m

⇒ Drill Dimensions



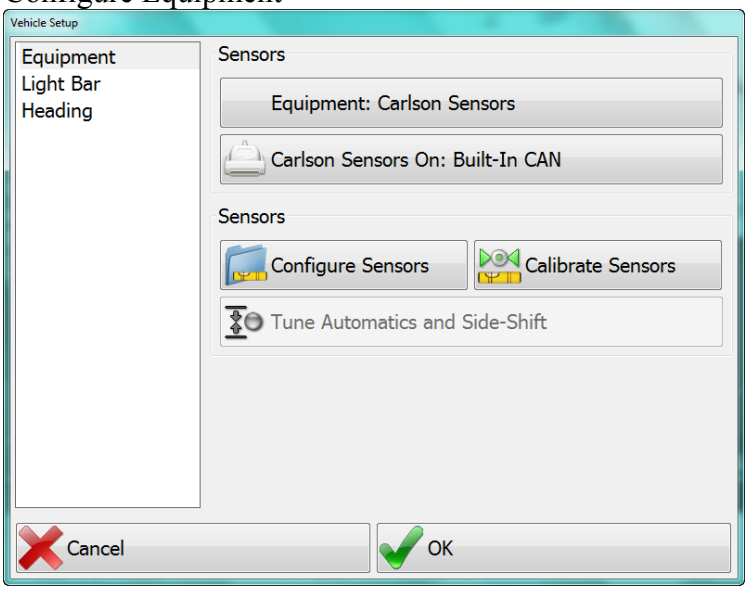

- Boom Length:
  - Boom length from pin to pin (pivot to pivot)
- Boom Height:
  - Boom pin to bottom of tracks (boom pivot to ground)
- Stick Length: (if applicable)
  - Stick length from pin to pin (pivot to pivot)
- Mast Height:
  - Vertical distance from Stick pin (Feeder to Boom pivot) to Collar
- Mast to Collar Offsets:
  - Right Offset: Horizontal Left/Right distance from Stick pin (Feeder to Boom pivot) to Collar. (Left of pin is negative value)
  - Forward Offset: Horizontal Forward/Backward distance from Stick pin (Feeder to Boom pivot) to Collar. (Backward of Collar is negative value)

⇒ Chassis Dimensions




- Length:
  - Total length on Chassis (Body)
- Width:
  - Total width of Chassis (Body) outside of tracks

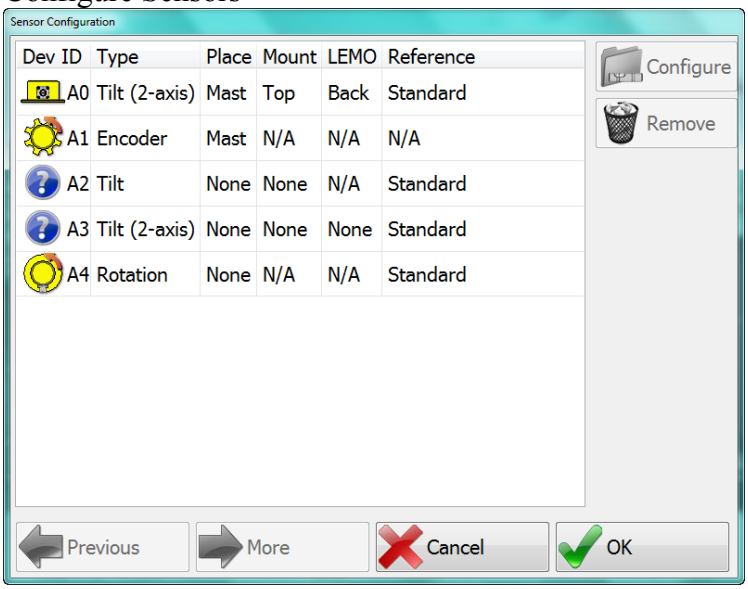
c) Configure Equipment




⇒ Equipment

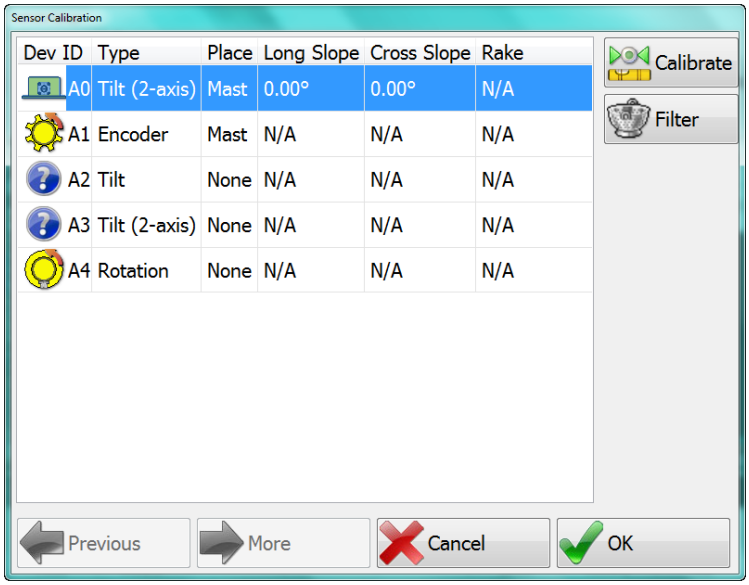
- Sensors:
  - Select type and manufacturer of Sensors
- Sensors On:
  - Communication port sensors are connected to. (Ex. COM 2 or Built-In CAN)

- Configure Sensors




  * Select each individual available sensor by highlighting the sensor and pressing configure. Select the configuration of:
    - Placement: location sensor is mounted
    - Mount: orientation sensor is mounted
    - LEMO Facing: orientation cable connection is facing in relation to machine.
    - Use Long Slope: Yes/No to use long slope data from sensor
    - Use Cross Slope: Yes/No to use cross slope data from sensor.

- Calibrate Sensors




  * Calibrate Sensors by highlighting each individual available sensor and pressing Calibrate. Calibration procedure will step you through calibrating each of the available sensors.

⇒ Light Bar:

- Option for 3rd Party light bar.

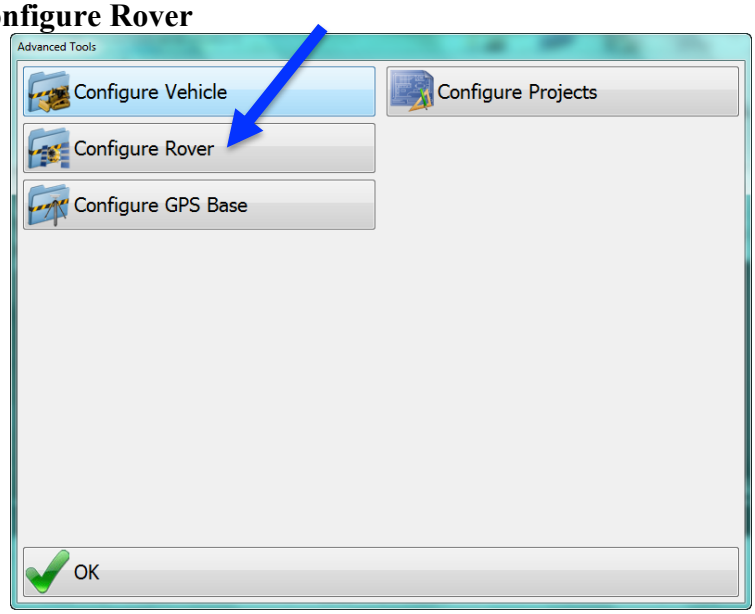
⇒ Heading

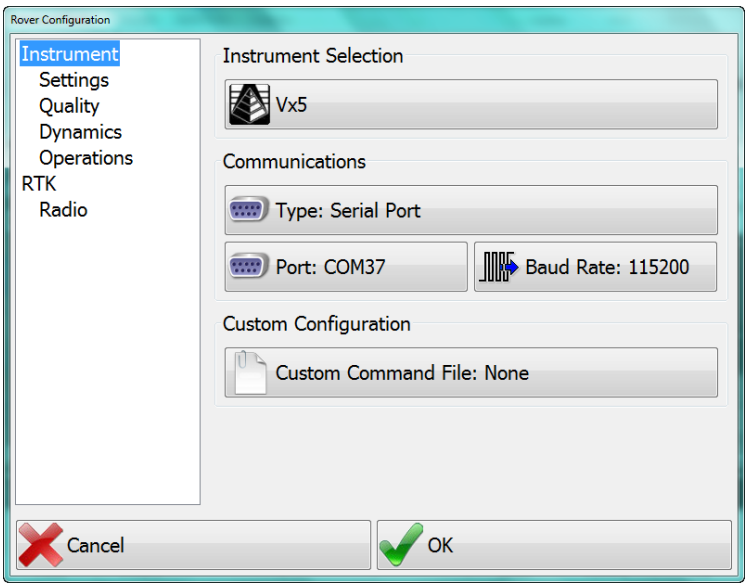
- Reverse Sensor On:
  - If applicable select the communication port that a reverse relay or reverse sensor is connected to. (Ex. Connection to Revers Alarm)
- Use Input Line:
  - DSR Line (Most Used)
  - CST Line
- Second GPS:
  - Select a second independent GPS receiver for heading calculations. The receiver will use positions compared to the primary GPS antenna position to calculate a vehicle heading.

d) Save Backup

⇒ Saves a Vehicle file (.vdf) with all settings and measurements entered in the Configure Vehicle menu. This file is stored in the /Data/Config directory.

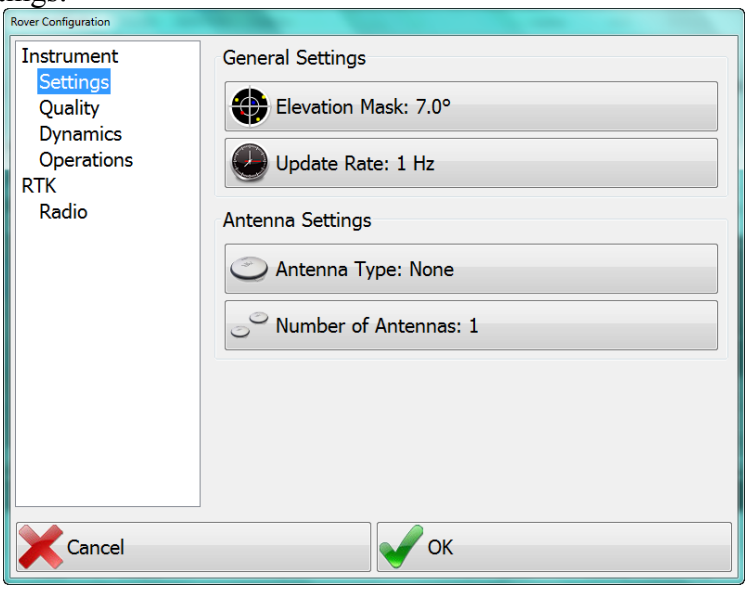
**2. Configure Rover**






a) Instrument:
- Choose instrument from list to use for Rover positioning.
- Communications:
  - Type: Type of communication connection.
    - Serial
    - Bluetooth
  - Port: Connection port for communication
  - Baud Rate: Communication speed
- Custom Configuration:
  - Option area to run custom script file when driver is loaded at startup.

⇒ Settings:



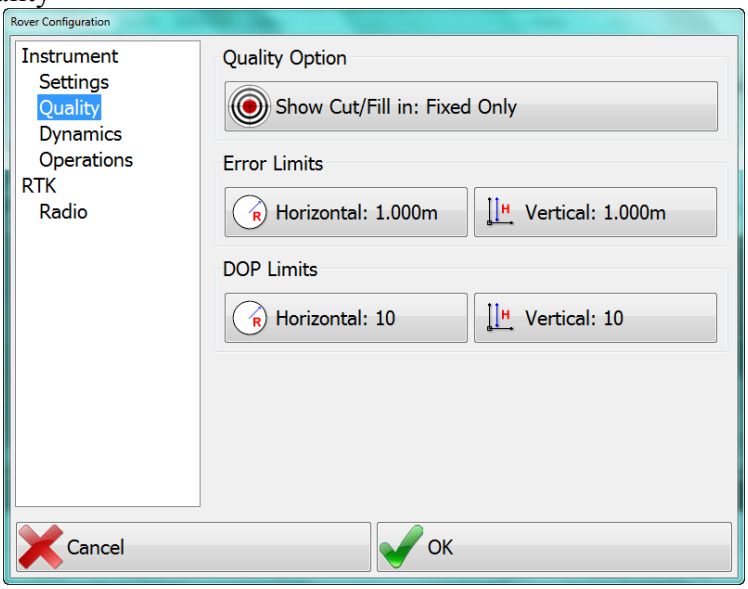

- General Settings
  - Elevation Mask:

- ♦ Degree above horizon where SAT signals are used. SAT signals received from low horizon satellites can sometimes be low quality. Ignoring these signals can produce better results in position.

* Update Rate:
  - ♦ Position update rate from SAT signals. (speed at which position updates)

• Antenna Settings:
* Antenna Type:
  - ♦ Select antenna from manufacturer list. The default phase center offsets of this antenna will be used for antenna position to ARP (Antenna Reference Point)
* Number of Antennas:
  - ♦ Number of Antennas used for position and heading. If additional GPS antenna is used to calculate heading in relation to primary rover antenna, this is set to (2)

⇒ Quality



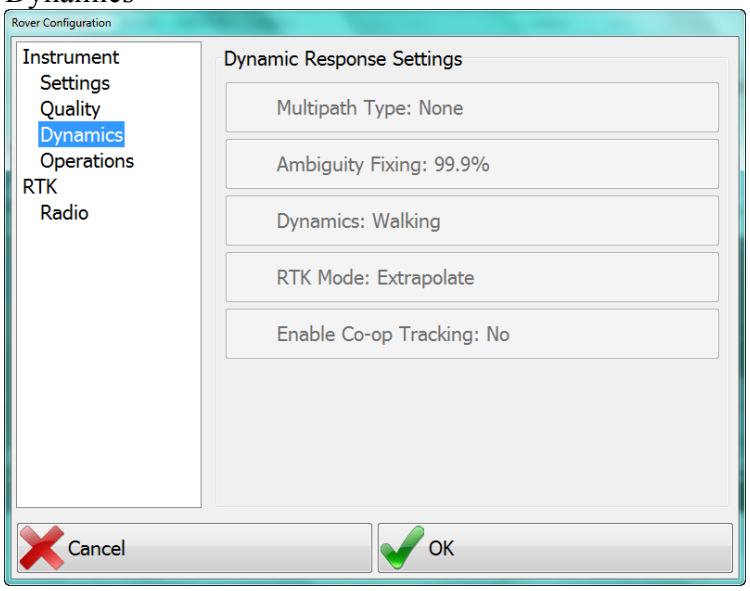

• Quality Option:
* Show Cut/Fill: (Display Cut/Fill Values in)
  - ♦ Fixed Only
  - ♦ Fixed and Float
  - ♦ Fixed, Float, and Autonomous

• Error Limits:
* Horizontal:
  - ♦ RMS Horizontal Limit for Cut/Fill values to be displayed when in Float solution. (Show Cut/Fill in: Fixed and Float selected)
* Vertical:
  - ♦ RMS Vertical Limit for Cut/Fill values to be displayed when in Float solution. (Show Cut/Fill in: Fixed and Float selected)

• DOP Limits: (Delusion of Precision)
* Horizontal:

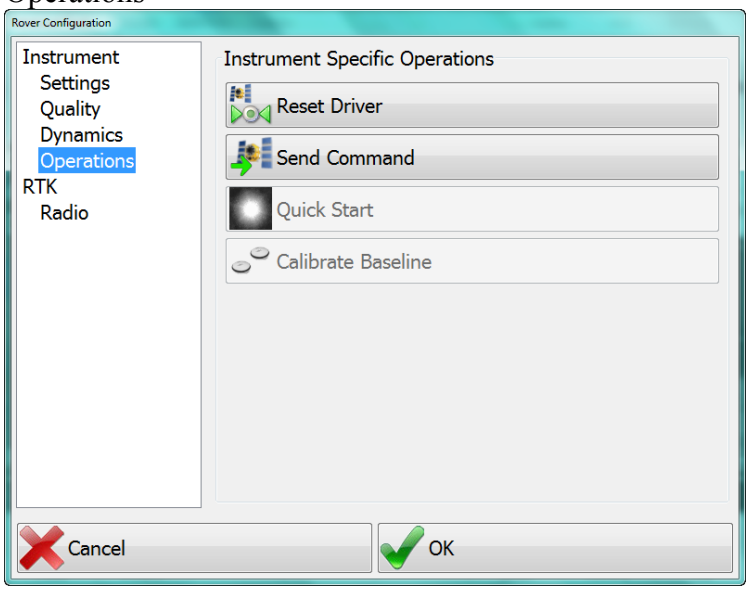
- ♦ Horizontal DOP limit at which Cut/Fill values are displayed. (Show Cut/Fill in: Fixed and Float selected)
- ∗ Vertical:
  - ♦ Vertical DOP limit at which Cut/Fill values are displayed. (Show Cut/Fill in: Fixed and Float selected)

⇒ Dynamics




- Dynamic Response Settings
  - ∗ Settings are available dependent on GPS receiver manufacturer design. See GPS manufacturer documentation for ability and configuration.

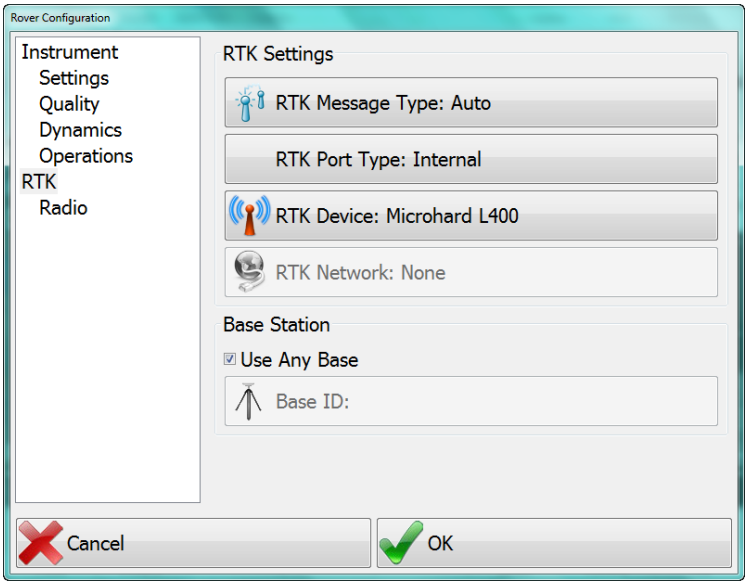
⇒ Operations




- Instrument Specific Operations
  - ∗ Reset Driver
    - ♦ Resets GPS receiver to factory user defaults (Receiver specific)
  - ∗ Send Command

- ♦ Opens command prompt for direct receiver communication using script commands

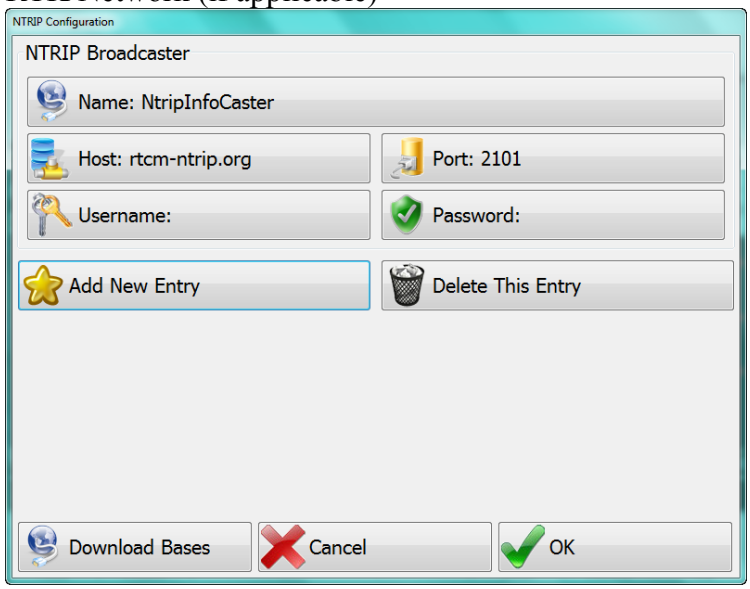
b) RTK




⇒ RTK Settings

- RTK Message Type:
  - ∗ Auto: monitors RTK message type and sets receiver to correct type. (receiver specific)
  - ∗ CMR
  - ∗ CMR+
  - ∗ RTCM 3.x
  - ∗ RTCM 2.3
  - ∗ Proprietary
- RTK Port Type
  - ∗ Communication port for RTK device or Radio
- RTK Device:
  - ∗ Available RTK device selection such as Microhard L400 UHF Radio, Pacific Crest ADL, Data Collector Internet (DC Internet: Allows internal internet connection be used to receive RTK correction via NTRIP, SpiderNET, Direct TCP/IP, Direct UDP/IP), Data Collector Radio (DC Radio: Allows external RTK Radio/Device receiving an RTK correction to port this correction through the connected COM port to another COM port or internal GNSS receiver within the computer console)

- RTK Network (if applicable)

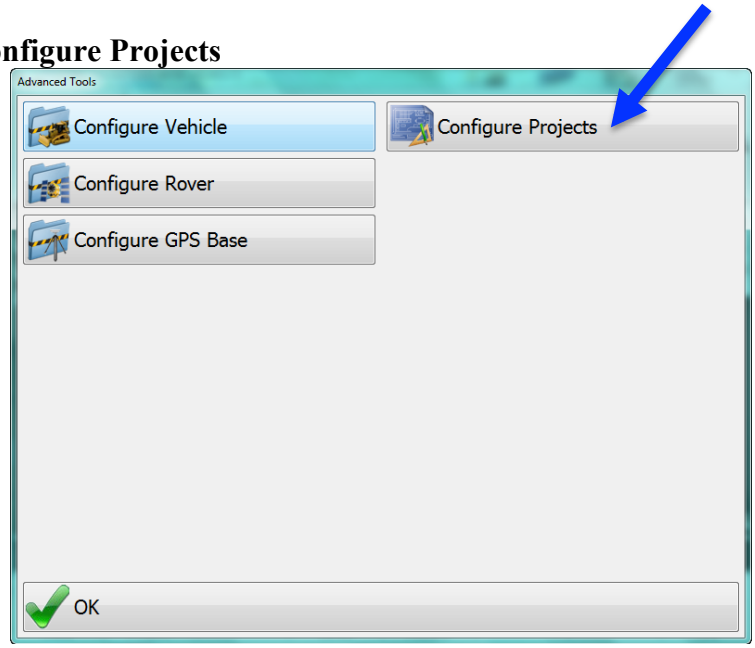



  - Name:
    - Name of NTRIP Caster:
    - Host: Address for NTRIP correction to be received from.
    - Port: Port number for NTRIP correction to be received from.
    - Username: Username credentials for login
    - Password: Password credentials for login
    - Add New Entry: User defined Caster name for Network configuration.
    - Delete This Entry: Deletes the Network Configuration.
    - Download Bases: Once Network configuration is completed, press Download Bases (mount points) and chose the mount point to use in the solution.

⇒ Base Station

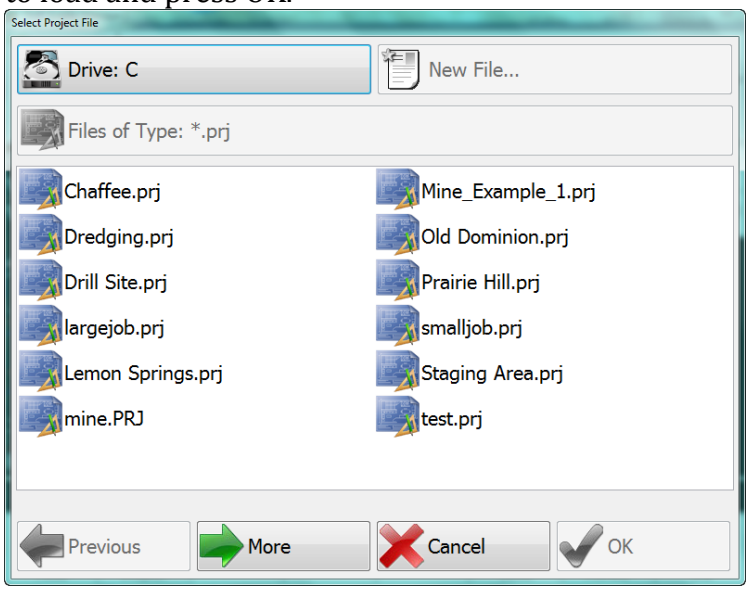
- Use Any Base:
  - Check this box is Base Station ID is unknown for RTK correction. If Base Station broadcast ID is known and recommended to use, enter the value in the Base ID window.

### 3. Configure Projects

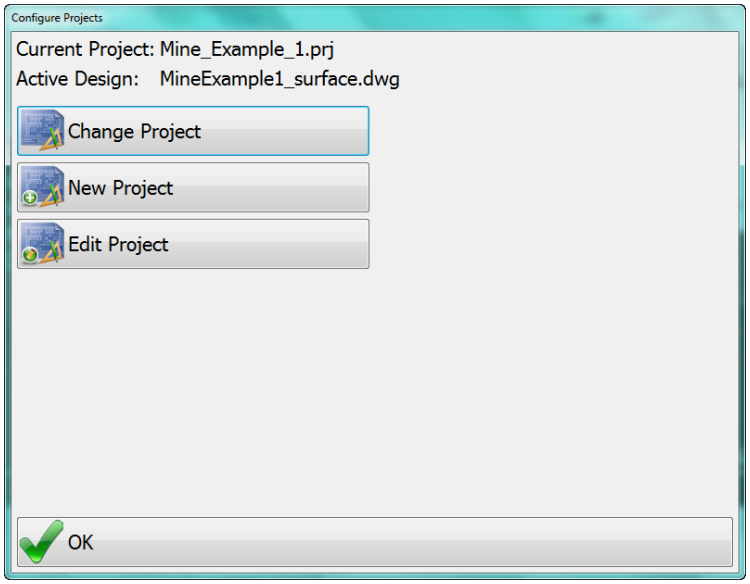



**Project Menu:**
The current active project is displayed. A project is nothing but a collection of plan view, design DTM, localization and other optional files (including coordinate, centerline and existing surface files) that are lumped together in a single, named project file. Since you can work to a selection of files without organizing them into a project, the Current Project can be "None".

**Project Button:** The Project button for the toolbar allows you to change between projects. The Project button does not allow adding files to a project or editing project options. This button is only used for changing projects and is designed to simplify operator interface when project file management is not handled in the field.
To change a project, press the project button from the toolbar, select the Project you wish to load and press OK.



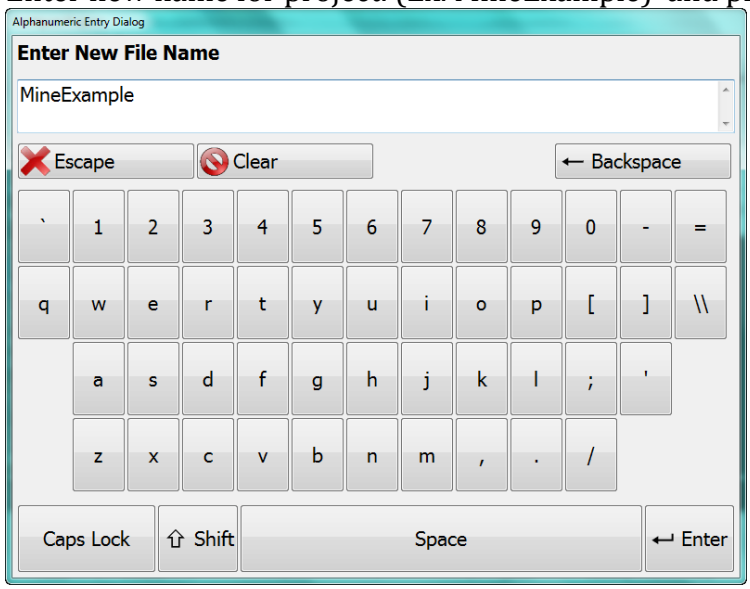
**Edit Project Button**: The Edit Project button allows you to create New Projects, Edit Projects, and change Projects. This button is present on toolbar as default when installing Carlson Grade programs onto a PC.
Press the Edit Project button to open Configure Projects menu

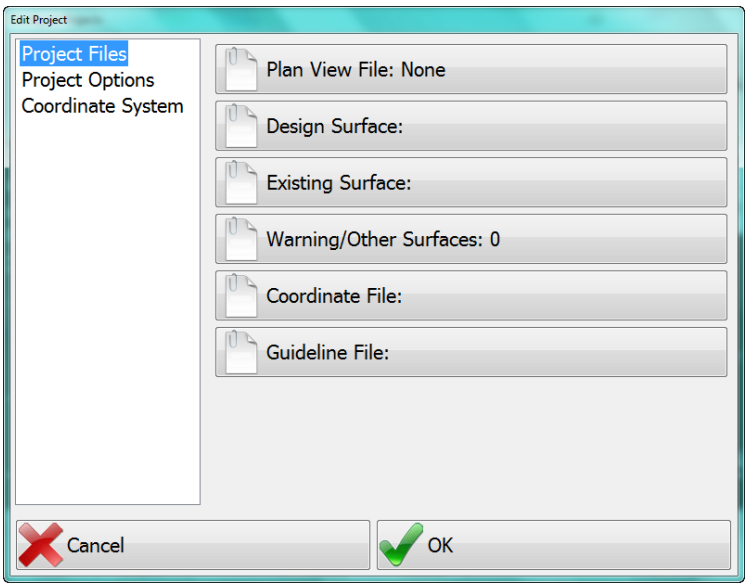



**Configure Projects**

**Change Project:**
Select Project from list to be loaded and active.
Highlight the Project you wish to load from the Data directory and press OK.

**New Project:**
To create a New Project, press "New Project" from the Configure Projects menu.
Enter new name for project. (Ex. MineExample) and press OK


Alphanumeric Entry Dialog
Enter New File Name
MineExample
Escape
Clear
Backspace
` 1 2 3 4 5 6 7 8 9 0 - =
q w e r t y u i o p [ ] \\
a s d f g h j k l ; '
z x c v b n m , . /
Caps Lock
Shift
Space
Enter




**Project Files:**

Types of File and Formats used in Carlson Grade are described in the previous section.

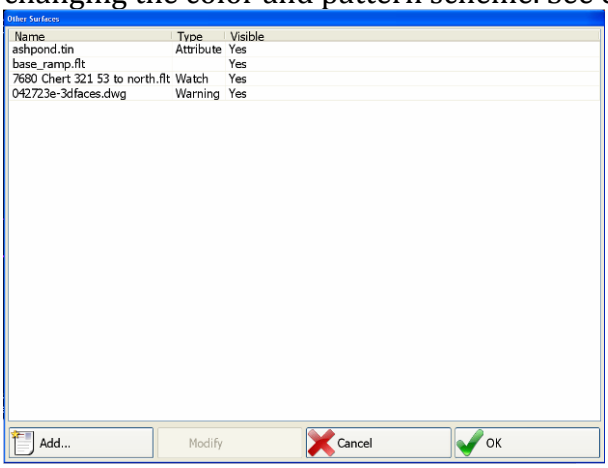
- **Plan View File:** Carlson Grade will read DWG and DXF files as the plan view file directly. It will also use PLN files created in Carlson Software office products such as SurvCadd, Takeoff, Carlson Survey, Leica Site Manager and TopSite. You must specify a plan view file. Whatever colors appear on the source file will appear on the file within Carlson Grade. However, bold linework will be presented at standard width. Text may appear on the screen in Carlson Grade. Even if a DWG file is used, only the polyline elements on the file will be captured by Carlson Grade. It is recommended that files be simplified before loading into Carlson Grade. Of most interest are roads, buildings, streams, top and bottom of slopes and other distinguishing features. Contours and excessive text usually add too much clutter to the plan view and are not recommended. Warning zones, such as boundary lines and underground utilities that are identified when exporting a PLN file from the Carlson Software office products, will be displayed as a bold orange polyline in the Carlson Grade plan view. You can also use warning and work zones by specifying the layers to be "warning" and "work" in a DWG or DXF
- **Design Surface:** The primary design surface drives the cut/fill values that are displayed in the status screens. Only one primary surface is allowed at a time. You will learn in the Operator Interface section how this can be swapped with one of two field designs making it the primary cut-to surface. If it is desired to change the color or fill properties of this surface, it must be done from within Edit Project.
  - **DTM Surfaces:** In order to compute cuts and fills, Carlson Grade needs a design surface. This surface can either be a grid, .dxf (of 3d faces) or a TIN file. A grid surface is composed of grid cells of fixed size. If the cell

size is 10x10 or 20x20, it cannot "see" a 2-unit wide ditch or sharp break. However, a TIN file (triangulation file) is as accurate as the source data, and would "see" any ditch, wall or sharp break in grade. Grid files are used mostly for mining applications and TIN files are typically used for construction and landfill applications. Grids have an advantage of covering large areas with reasonable file size (subject to grid dimension used) and are fast for processing purposes. Grid files should be kept under 5mb in size, however. TIN files, if sites are very complicated and have lots of breaks in grade, can quickly become very large. It is also recommended that TIN files be kept under 2mb, if possible, for optimum processing speed. Carlson Grade will also show Cut/ Fill to a fixed elevation as entered by the operator.

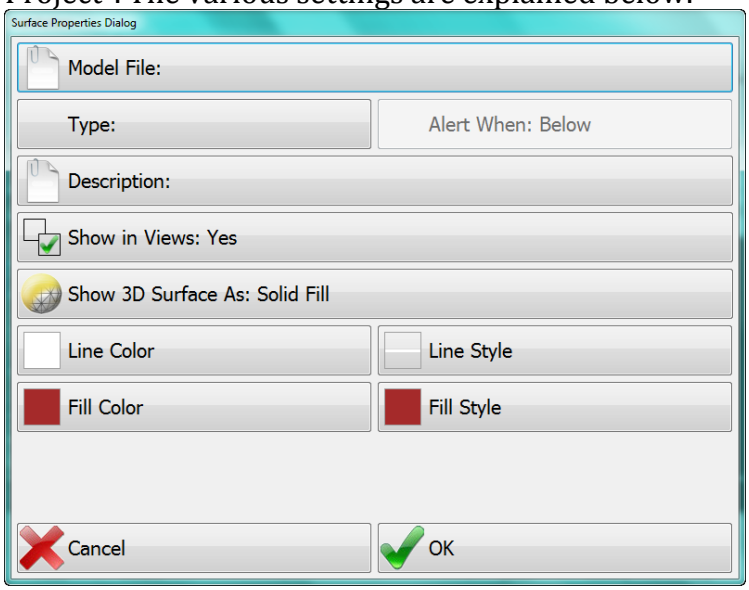
  - DTM grid surfaces can also be used as warning grids (above the grid, a warning is issued, particularly useful for feeder applications). DTM grids can also be used to present a quality attribute (like sulfur, sodium or BTU) during grading

- **Existing Surface:** This surface is generated by the vehicle as it alters the current surface and can be used to update your primary design surface. In addition, there is a setting to show existing surface changes for cut only or both cut/fill. For example, when digging a trench with an excavator, you will want this set to cut only. If not set accordingly, every time the bucket is raised, the surface will be filled back in. A good time to set the existing surface to update both cut and fill is when a dozer is working in an active dumping site. Only one existing surface is allowed at a time. The existing surface DTM grid has a predefined scheme of an empty fill and a dashed white line, so it appears as a line overlaying the other surfaces. To change the color or fill properties of this surface you must configure the option within Edit Project.
- **Warning/Other Surfaces:** These surfaces include: other, warning, or attribute. Warning grids issue a warning when the vehicle is either above the grid or below the grid (such as a water surface). The attribute surfaces can be used to present a quality attribute (e.g. sulfur, sodium, ash, or BTU) during grading. This will display a labeled value on the plan view or some other view when the plan view is not activated. Only one attribute grid is allowed. However, more than one warning surface is allowed to appear in the plan view. If a slope or flat pad has been chosen and made for quick swapping (see Chapter 5), they will also show up in the "Other Surfaces" list. The only thing that can be done to these surfaces however, is deleting them and

changing the color and pattern scheme. See example:




* When “Other Surfaces” is selected, the previous screen is displayed. If adding a surface, select “Add”. If removing a surface, select “Modify”, then delete from the next screen.
* Changing Surface Properties: When an “Other Surface” is selected from “New” or “Modify”, the screen above allows for changing the properties of the surface, including type and description. This screen will also be displayed for primary and existing surfaces, but only from within “Edit Project”. The various settings are explained below.

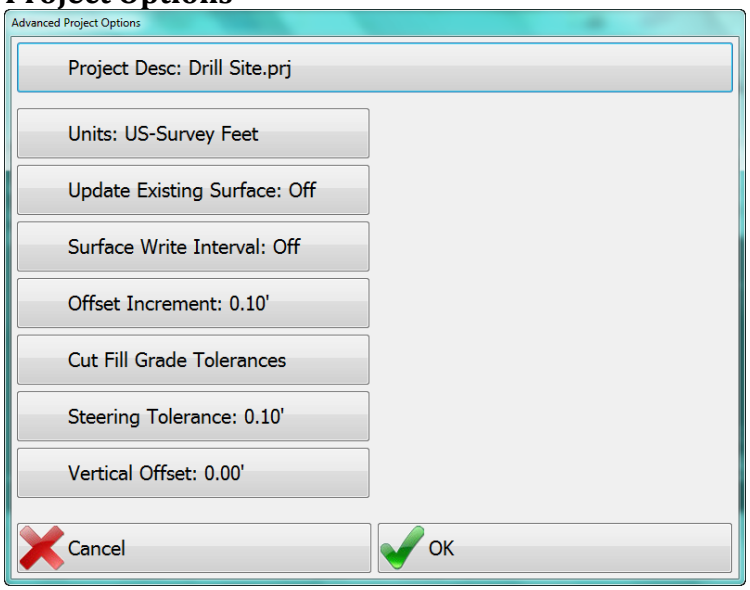



- Model File: A grid or TIN file can be selected or an elevation for the surface can be entered. Elevation will display: “Pad at” specified elevation.
- Type: This can be of type attribute, warning, watch, or none.
- Alert When: If a warning surface is selected, then the software will warn the operator when he or she are above or below the surface. Examples of this are: warn when below a water surface and warn if above an open slope.

- Description: This will help specify what the surface represents. If the surface is a warning surface, this is what will be displayed in the warning message. If the surface is an attribute grid, then this is what will be displayed.
- Show in Views: This lets the user decide what to show in the plan view. Turning the surface off means that the surface will not be drawn and therefore you will not have corresponding cut/fill.
- Line Color: This is the line color of the surface to be shown in the side and back views.
- Line Style: This is the line style of the surface that is to be shown in the side and back views.
- Fill Color: This is the fill color of the surface to be shown in the side and back views.
- Fill Style: This is the fill style of surface to be shown in the side and back views.

- **Coordinate File:** This optional file is used when coordinates are stored by "Auto Store at Interval", "Store Point" and point storage options. The active coordinate file is also useful when recalling points for localization. If they are already entered into the coordinate file, there is less likelihood of a typographic error versus loading a localization file (from SurvCE or other survey software). can be created in the field and must be pre-loaded into the field computer.
- **Guideline File:** Sometimes referred to as the "horizontal alignment", this file produces station and offset reporting when loaded. Whenever the equipment is perpendicular or radial (on curves) to the centerline, the station and offset will appear on the screen as a display option. This is a useful reference for operators on highway projects, for example. This file can be created in Carlson office products (such as Carlson Survey, Carlson Roads, SurvCadd, Takeoff, etc.) or a file can be named when an alignment (guideline) is selected directly from the screen and can then be loaded into Carlson Grade.

## Project Options




⇒ Project Desc:
- User defined description for loaded project. Shows in status bar in main screen. Can be used to differentiate between two areas in a site. For example: Cell C Seam B

⇒ Units:
- US-Survey Feet: United States survey foot is defined as 0.3048006096 m
- International Feet: Defined to be equal to exactly 0.3048 meter
- Meters: International System of Units

⇒ Update Existing Surface:
- Cut: Updates existing surface in Cut only
- Cut/Fill: Updates existing surface in Cut/Fill both
- Off

⇒ Surface Write Interval:
- User defined time period when surface is updated (ex: every 60 seconds)

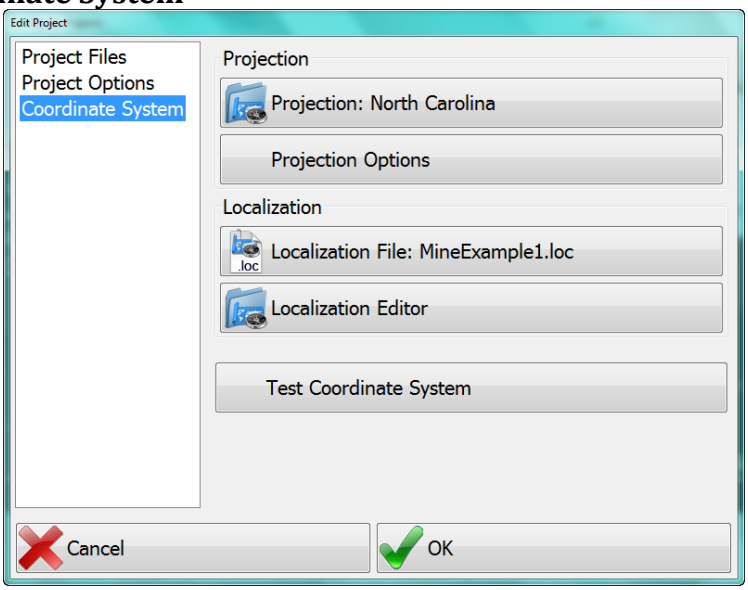
⇒ Offset Increment:
- The vertical offset value will change at this amount when the vertical offset up/down arrows are pressed in main screen.

⇒ Cut/Fill Grade Tolerances:
- Select the color and tolerances of above/below grade (Cut/Fill) and also the On Grade width or tolerance.

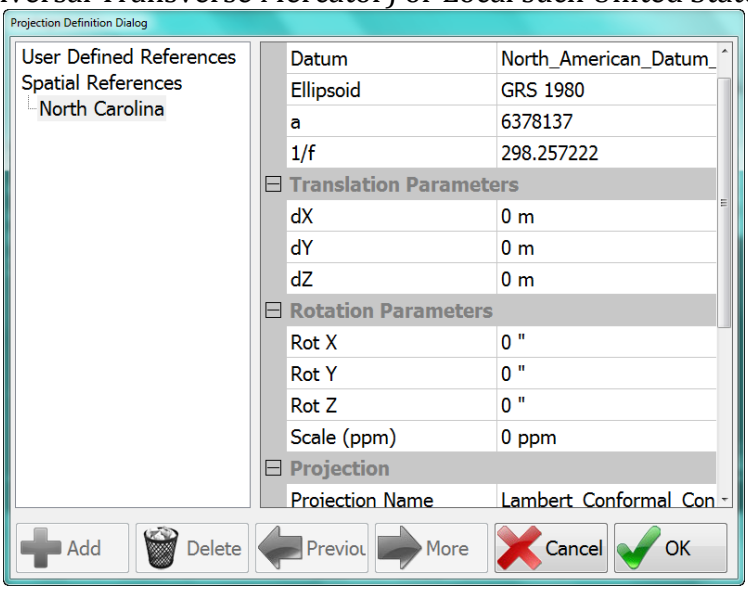
⇒ Steering Tolerance:
- Enter Tolerance for steering to a guideline. On grade Indication (Left and Right) when guideline is turned on.

⇒ Vertical Offset:
- Value at which the vertical offset will be set each time the project is loaded.

## Coordinate System

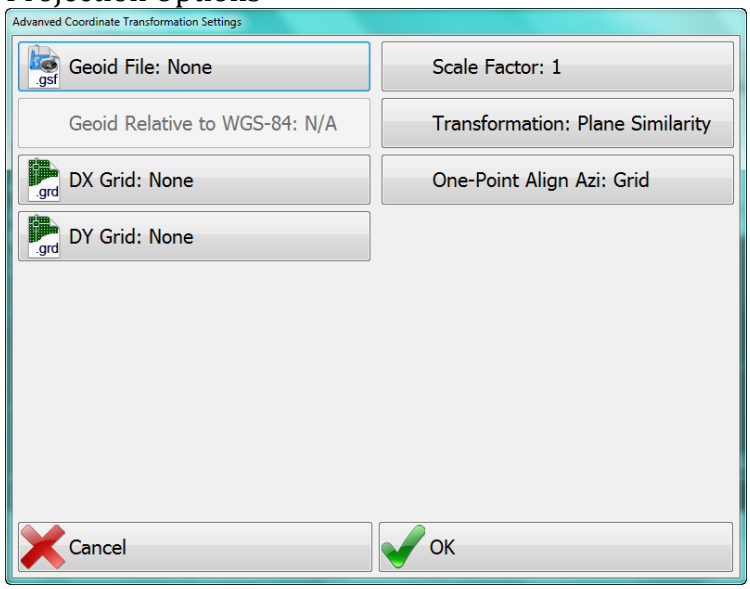



⇒ Projection: A projection is any method of representing the surface of a sphere or other three-dimensional body on a plane. Projections can be global such as UTM (Universal Transverse Mercator) or Local such United States/Texas/(North)




- Select the Projection Definition for your project area. Select correct Datum, State Grids, etc for the project area.

- Projection Options




  - Geoid File:
    - If applicable for the project, load Geoid file for area.
  - Scale Factor:
  - Geoid Relative to WGS-84 if applicable
  - Transformation:
  - DX Grid:
  - DY Grid:
  - One-Point Align Azi:
- Localization File

## Localization:

A localization file contains the projection coordinates and matching local coordinates for control points in the project. At mines and landfills, one localization file usually covers the mine site and is never changed. For construction companies moving from site to site, localization files do change frequently and are loaded in this routine. This feature allows for loading a pre-existing localization file created by Carlson Grade, Grade Supervisor, SurvCE, Topcon Pocket 3D, or Carlson Field or to create a new localization file by reading the GPS. Before loading or creating a localization file, make sure the correct projection has been selected.

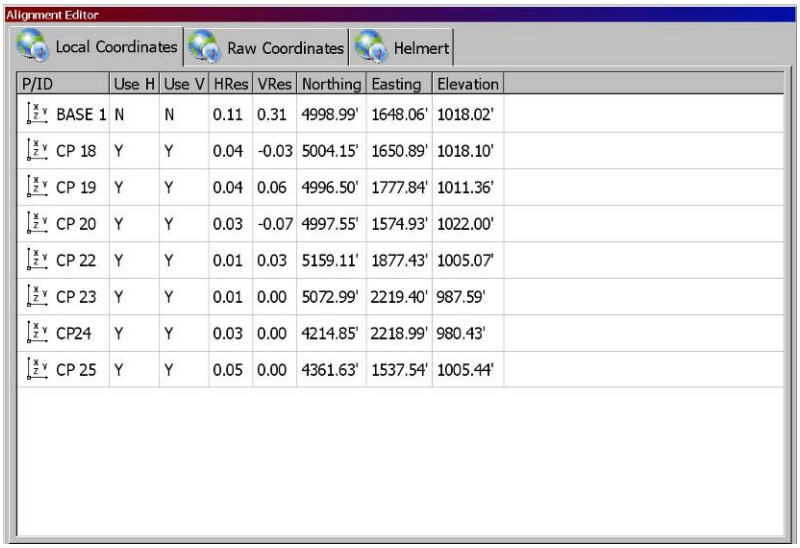
# Localization Editor:

The Localization Editor allows you to create a new localization file, Add and/or delete localization points, and turn ON / OFF Vertical and/or Horizontal component control.

### Create New Localization File:

Press the Add button and select whether the local coordinates will be typed in or if the point is in the current coordinate file. After entering the coordinates or point number, you will be prompted for whether you want to enter the lat/long/height or read it from the GPS. If you select Read from GPS, you will see a window that shows the current status of the GPS.

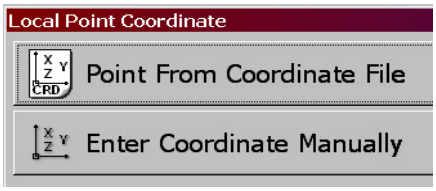
Make sure the GPS antenna is plumb and in the correct position over the point and press the Read button to start averaging the positions. When finished, the results are shown for acceptance. The positions are shown in the coordinates of the current projection (Local, State Plane or UTM). The items of importance on this screen are the Standard Deviation (Std) values toward the end of each average position line. These numbers indicate errors of the position, so you want to make sure each number is close to zero.
After pressing OK, you will see the new point in the alignment window. You should collect at least three or four known points in this manner. After shooting in your localization points, check the Vertical (VRes) and Horizontal (HRes) Resolution for accuracy. These numbers should be close to 0.



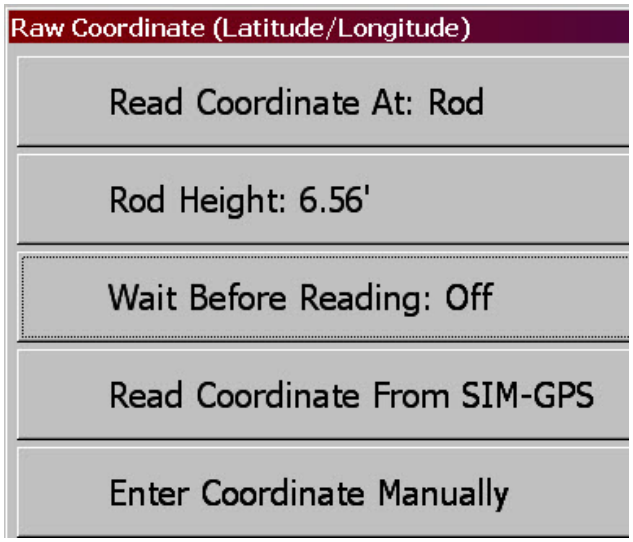

| P/ID | Use H | Use V | HRes | VRes | Northing | Easting | Elevation |
|---|---|---|---|---|---|---|---|
| BASE 1 | N | N | 0.11 | 0.31 | 4998.99' | 1648.06' | 1018.02' |
| CP 18 | Y | Y | 0.04 | -0.03 | 5004.15' | 1650.89' | 1018.10' |
| CP 19 | Y | Y | 0.04 | 0.06 | 4996.50' | 1777.84' | 1011.36' |
| CP 20 | Y | Y | 0.03 | -0.07 | 4997.55' | 1574.93' | 1022.00' |
| CP 22 | Y | Y | 0.01 | 0.03 | 5159.11' | 1877.43' | 1005.07' |
| CP 23 | Y | Y | 0.01 | 0.00 | 5072.99' | 2219.40' | 987.59' |
| CP24 | Y | Y | 0.03 | 0.00 | 4214.85' | 2218.99' | 980.43' |
| CP 25 | Y | Y | 0.05 | 0.00 | 4361.63' | 1537.54' | 1005.44' |

**Add / Delete Localization Points:**

By pressing the Add button in the Localization Editor, you can add points manually or choose from a coordinate list.

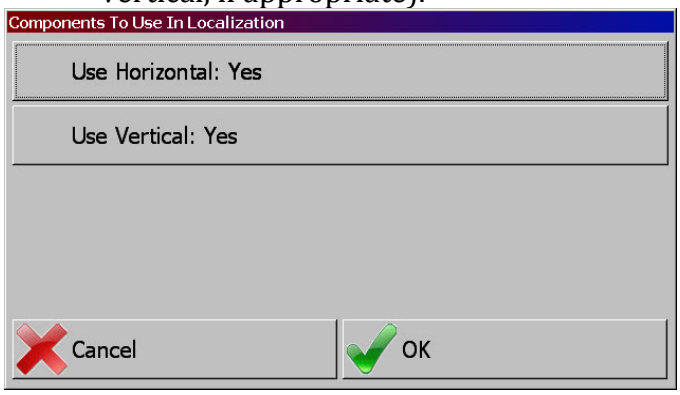



An example scenario: If you notice that you have a bad (busted) control point and need to replace it with the correct coordinates (NEZ), simply highlight the bad point and press delete. Next, press the Add button and type in the correct information or choose the coordinate from a coordinate file. You can then type in the known Raw (Lat, Long, and Ellipsoidal Height) coordinates of that specific point or choose to shoot it (take an average reading) again.




**On/Off Vertical/Horizontal Component Control:**

To use this option you will need to tap twice on the coordinate of choice then you can turn on/off horizontal or vertical information for this point. This allows you to remove the horizontal or vertical components of your localization points. This is a frequently used feature that enables use of one point for vertical control only (turn off its horizontal component) and other points for horizontal control (turn off their vertical, if appropriate).




## Discussion of Localization Techniques:

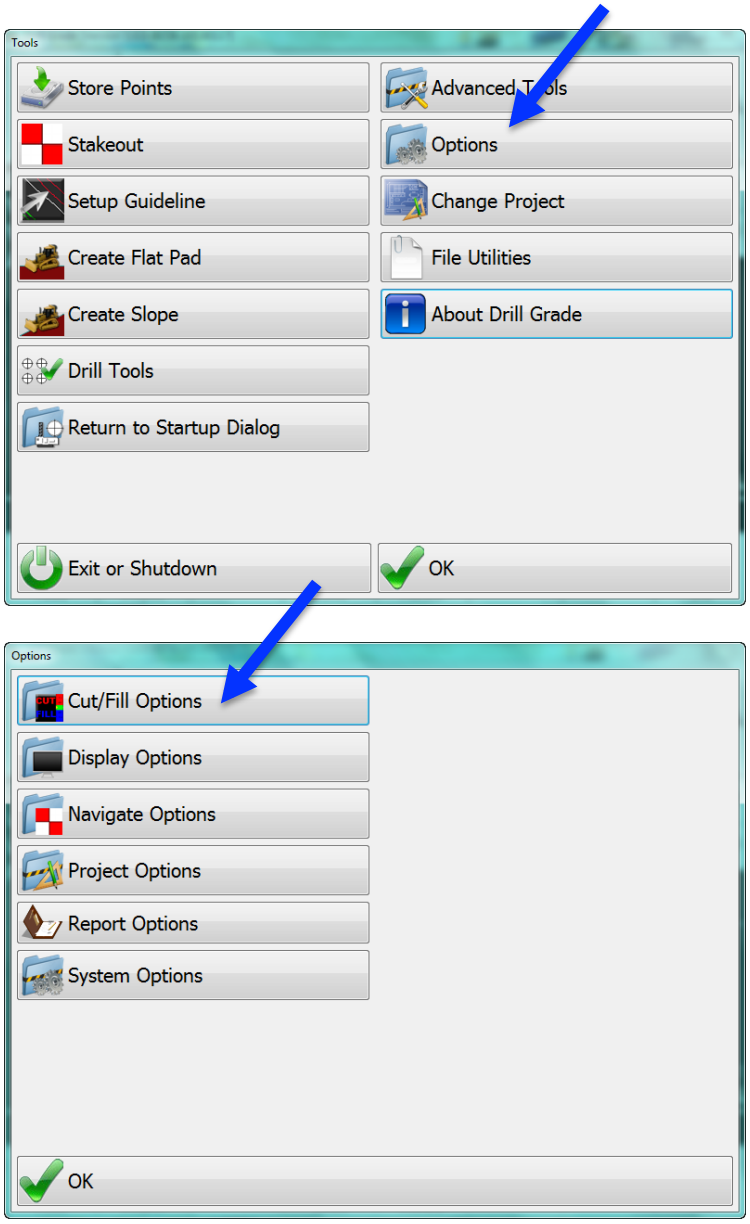
⇒ If you do a base localization by entering latitude and longitude or known coordinates on the designated coordinate system, you do not need to add localization points. A base localization would put you on grid north and grid scale and would work for any new job where you are not trying to match existing coordinates. However, any time you are working on a project that has existing coordinates, you will most likely need to re-localize. Even if that existing job is supposedly on State Plane, UTM or another known coordinate system, the project coordinates often fail to match the grid scale and grid north exactly, requiring a re-localization. While localizing, it is advisable to use at least 3 points for horizontal control and 4 points for vertical control in order to get a measure of residuals. (The program will "best fit" a plane through all activated

control points.) A residual is a measure of error pertaining to the best-fit plane. For example, if you are seeing high numbers (numbers greater than one) in your residuals, then the localization is not very accurate and it may indicate the known points need to be setup differently or you need to make sure you measure each known point accurately. Since multiple elevation points may create a slightly tilted plane, some surveyors will verify that the vertical control has low residuals and is accurate using multiple vertical control points, then turn off all but one point and use only the nearest elevation as they progress through the job.

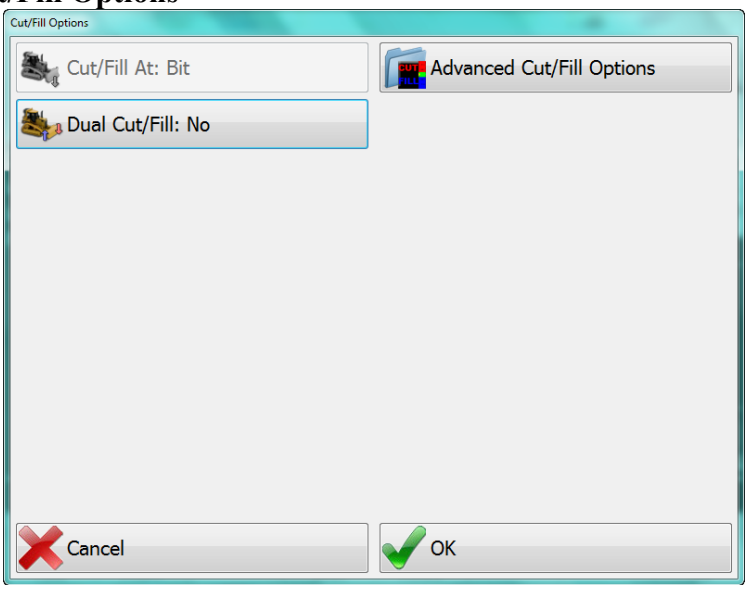
    - This file is required and can be created within *Carlson Grade* or loaded from an established localization file. It works in conjunction with the configured projection (coordinate system), which may be UTM (by zone) or U.S. State Plane 27 or 83 (by state), for example. You can load a localization file into *Carlson Grade* that was made using Grade Supervisor, SurvCE, Topcon Pocket 3D, or Carlson Field. The localization file is a Carlson-specific format. The localization file can be selected during project creation under Projects/ New Project, or under the Configure Projects menu.

- Localization Editor: Localization Editor allows changes to be made to the localization file. Add and/or delete localization points, and turn ON/OFF Vertical and/or Horizontal component control. For example, it is possible to use solely the vertical values of a control point if the horizontal is unknown or skewed.
- Test Coordinate System
    - Enter known coordinates for a location. (Example Lat 84 °23’12.2432) Press calculate to show details and relationship to occupied position. These results will help confirm the correct projection is being used.

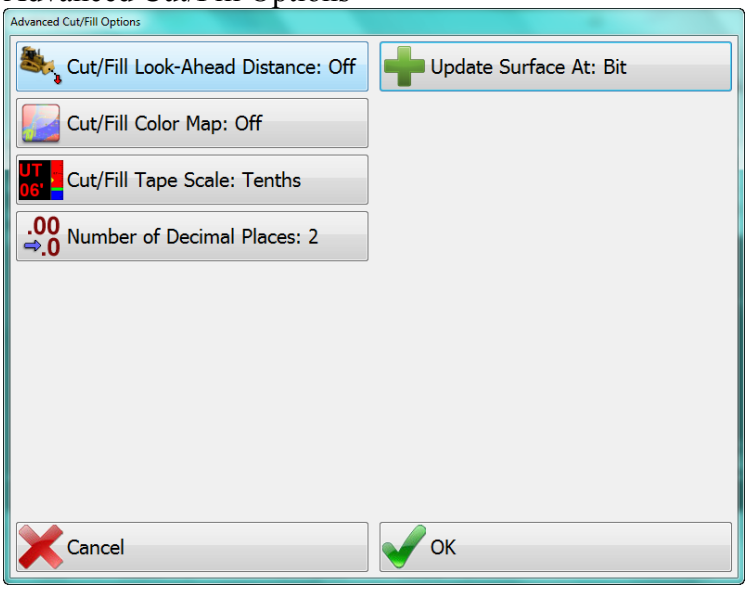
**Options:** The options menu is used for customization of toolbar, cut/fill parameters and tolerances, units, languages and other operator settings.



## 1. Cut/Fill Options




a) Cut/Fill Location at Bit only in Drill Grade
b) Dual Cut/Fill: N/A in Drill Grade program
c) Advanced Cut/Fill Options




⇒ Cut/Fill Look-Ahead Distance:
- Enter the projected Cut/Fill distance ahead in correlation with the machine heading. This option can provide an approximate Cut/Fill value to a design surface in advance of reaching the location.

⇒ Cut/Fill Color Map:
- On/Off : Turns on a color map that represents cut/fill data from one pass to the next.

⇒ Cut/Fill Tape Scale:
- Tape margins in Tenths of a foot
- Tape margins in hundredths of a foot
- Tape margins in Millimeters

- Tape margins in Centimeters

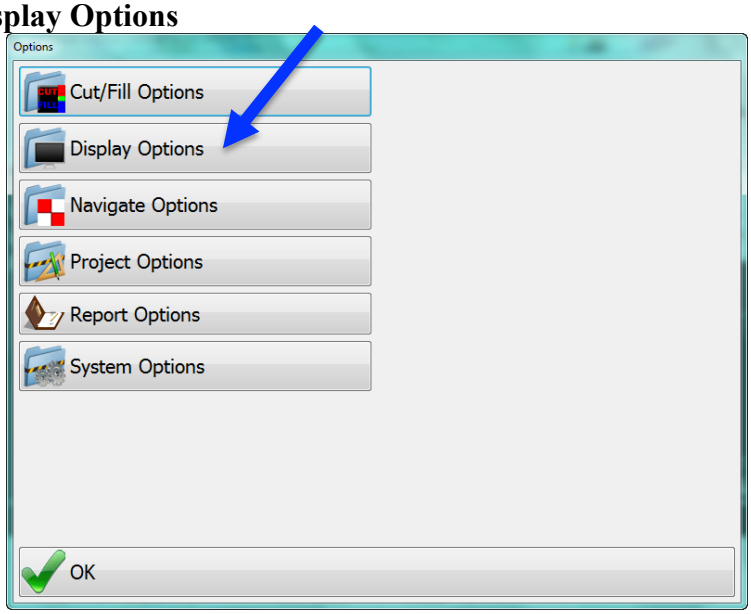
⇒ Number of Decimal Places:

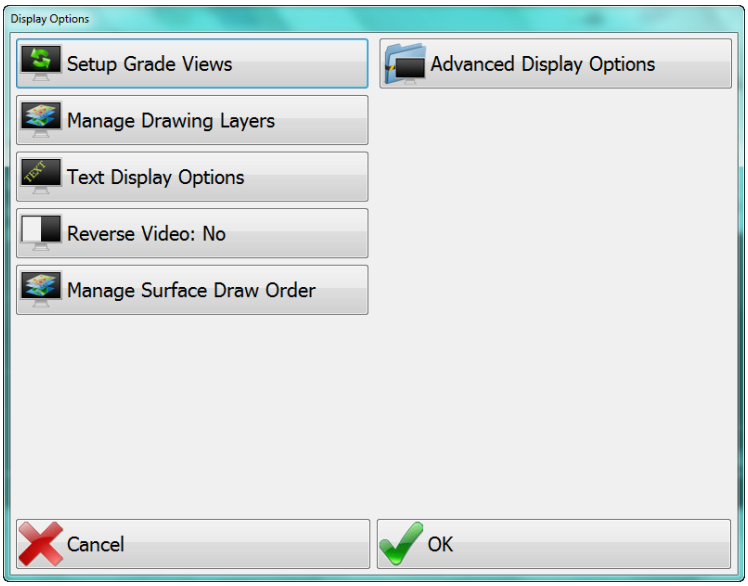
- 1, 2,or 3 decimal places to show in the Cut/Fill data screen.

⇒ Update Surface At:

- Location in Drill Grade is Bit only. This is location of where existing surface and/or Cut/Fill Color Map is updated.

**2. Display Options**




a) Setup Grade Views

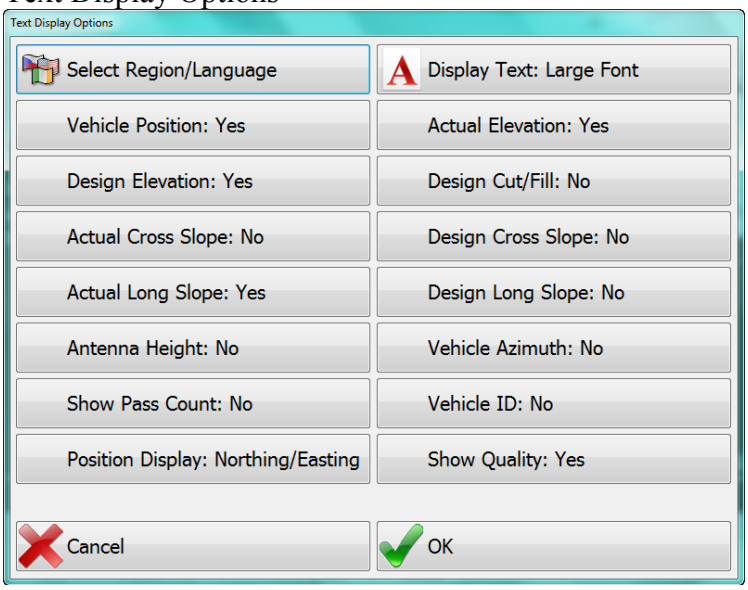
⇒ Toggle on/off the views you want available for operators.

⇒ You can change the order at which the views are available when cycling through from the main screen

b) Manage Drawing Layers

⇒ Freeze and Thaw layers (CAD function) to choose what to show and what not to show in the plan view on the main screen. (Map View)

c) Text Display Options



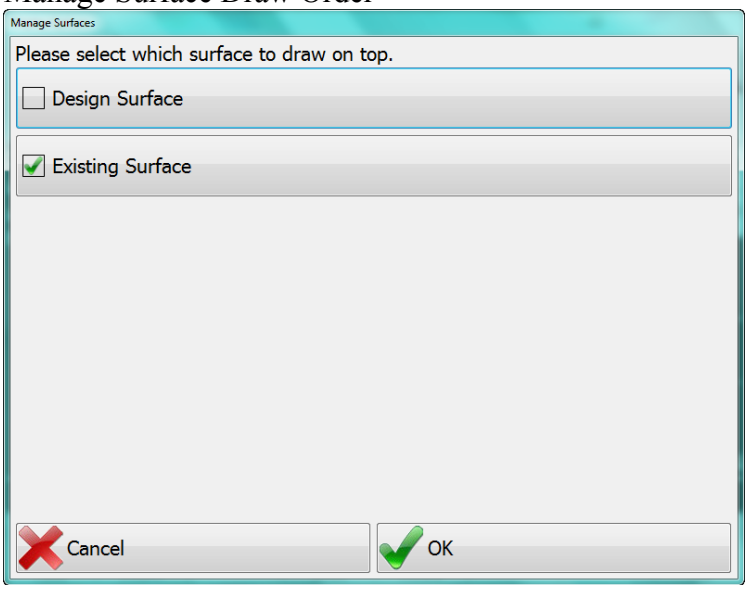

⇒ Select Region/Language
⇒ Vehicle Position: Lat/Long position of vehicle
⇒ Design Elevation: Elevation at design surface in reference to vehicle position.
⇒ Actual Cross Slope: Left to Right slope value in percent or ratio
⇒ Actual Long Slope: Back to Front slope value in percent or ratio
⇒ Antenna Height: Antenna Height above existing terrain. (tracks)
⇒ Show Pass Count: Number of passes over a common grid that the vehicle has occupied.
⇒ Position Display:
- Northing / Easting
- Easting / Northing
- Chainage / Offset (guideline function)

⇒ Display Text:
- Small Font
- Large Font
- Extra Large Font

⇒ Actual Elevation: Elevation of Cut/Fill location at vehicle's current position.
⇒ Design Cut/Fill: Cut/Fill Value of current position in relation to design surface.
⇒ Design Cross Slope: Left to Right slope value in percent or ratio at current vehicle position in relation to design surface. (cross section)
⇒ Design Long Slope: Back to Front slope value in percent or ratio at current vehicle position in relation to design surface (profile section)
⇒ Vehicle Azimuth: Heading or Azimuth in Degrees
⇒ Vehicle ID: ID listed for Vehicle (equipment number for example)
⇒ Show Quality: Shows GPS Quality (Fixed, Float, Stand Alone)

d) Reverse Video:
⇒ Changes the display from Black to White background and vice versa for Daytime or Night viewing.

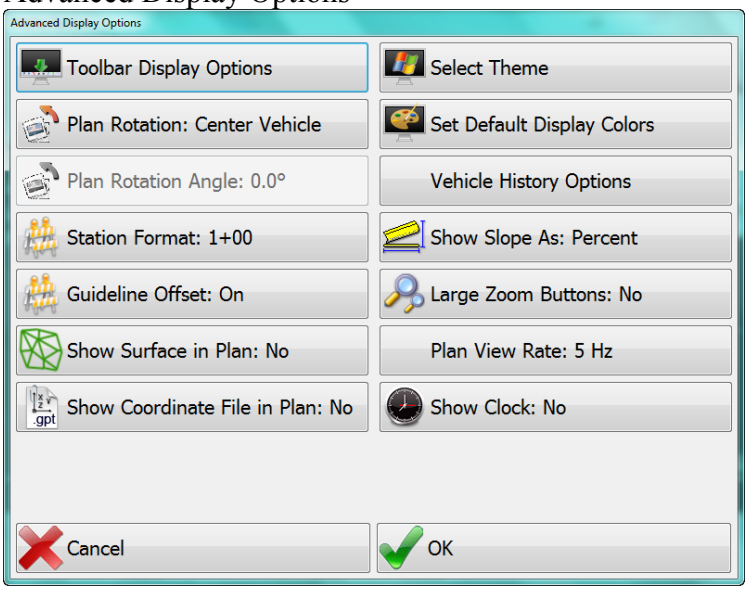
e) Manage Surface Draw Order



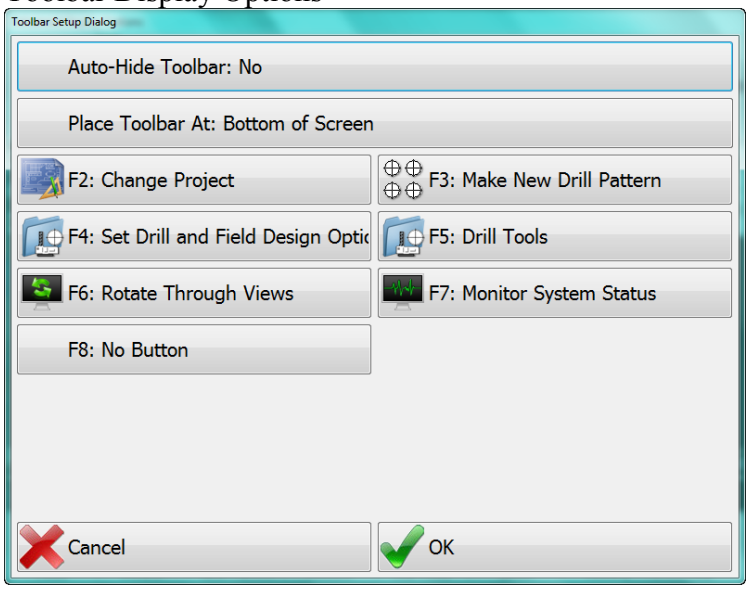

⇒ Draw Design Surface on top

⇒ Draw Existing Surface on top

f) Advanced Display Options



⇒ Toolbar Display Options




- Auto-Hide Toolbar: The toolbar will disappear after 5 seconds to give operator more area on screen to view plan view data, etc. Please the "Menu" button on screen to bring toolbar back up momentarily.
- Place Toolbar At:
  - Top of Screen
  - Bottom of Screen
  - Commander Style (7" widescreen Format"
- F2 – F8 toolbar buttons are configurable by selecting the button type from a list and pressing OK.

⇒ Plan Rotation:

- North Up: Vehicle moves on background while Plan View remains. Plan view is oriented with North at top of screen.
- Center Vehicle: Vehicle remains in center of screen while background updates.
- Moving Map: Vehicle remains in center facing top of screen while background updates and rotates depending on heading of travel.
- Custom Angle:

⇒ Plan Rotation Angle: Enter the heading/azimuth degree to lock the plan at a custom angle.

⇒ Station Format:

- 1+00 format
- 1+000 format
- 100 format
- BRG+DST (Bearing + Distance)
- OFF

⇒ Guideline Offset: On/Off

⇒ Show Surface in Plan:

- Shows a triangle mesh of the design surface. Indicates in the plan view location on design surface. This is a nice way to troubleshoot when in an area with no Cut/Fill data.

⇒ Show Coordinate File in Plan:
- Coordinate file points will be visible in the plan view on main screen. Helps to show location of previously stored points.

⇒ Select Theme:
- Select a Microsoft windows theme for the system

⇒ Set Default Colors:
- Change color of various entities so easier to recognize or see in the plan view screen. Images such as Cut, On Grade, Localization Point, etc can be customized with different user defined colors.

⇒ Vehicle History Options
- Quickly show a trace of where a vehicle has been over a user defined period of time.

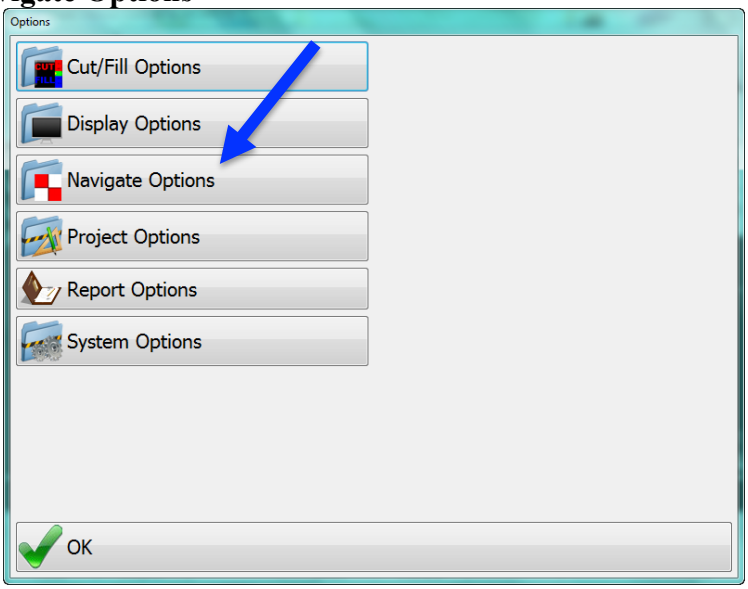
⇒ Show Slope As:
- Percent: %
- Degrees: °
- Rise/Run: 3/1
- Run/Rise: 1/3

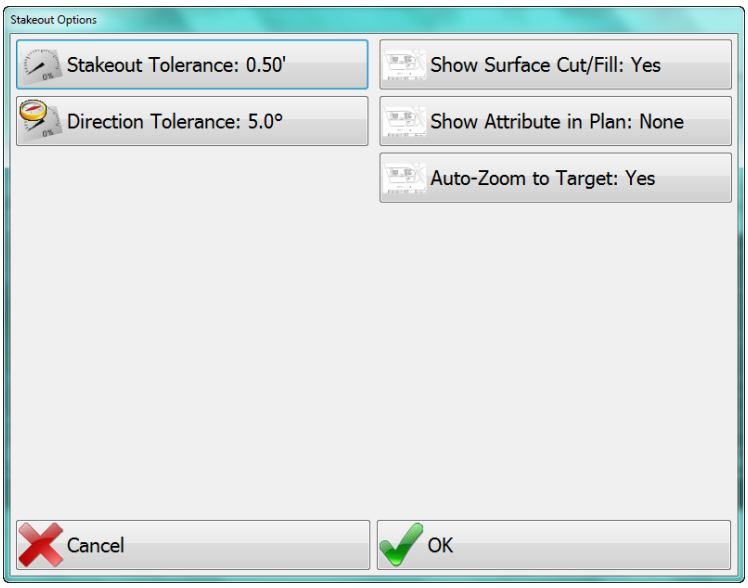
⇒ Large Zoom Buttons:
- Larger Zoom buttons for easier selection.

⇒ Plan View Rate:
- 1Hz, 2Hz, 5Hz, 10Hz, and 20Hz are available. Higher the number, faster the screen updates.

⇒ Show Clock:
- Shows current time is status window

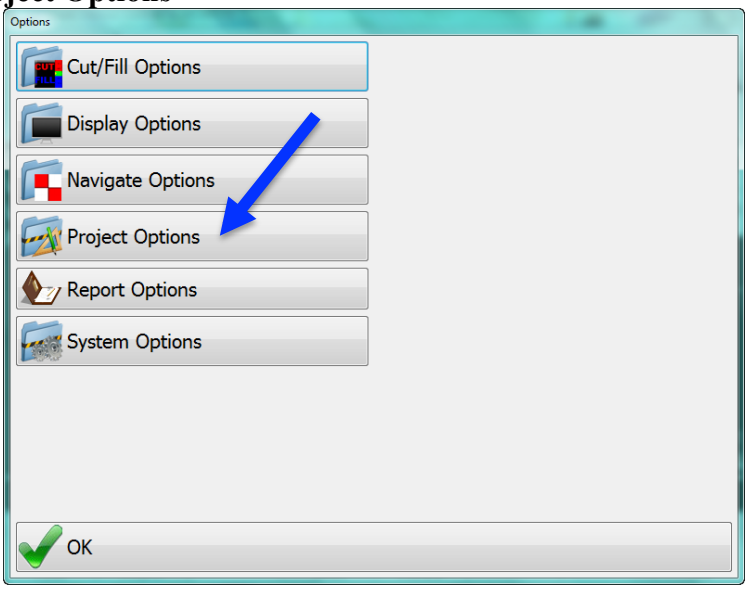
**3. Navigate Options**

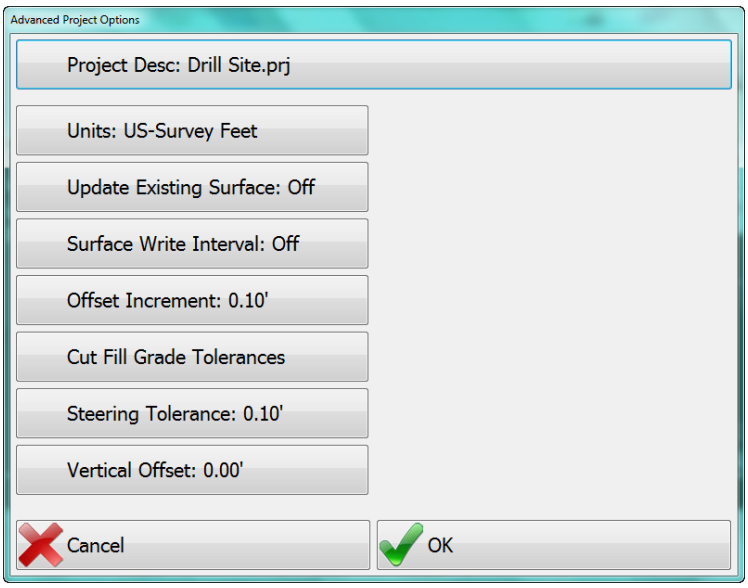





a) Stakeout Tolerance:
   ⇒ Tolerance of the target radius when the target (bullseye) will rotate. The rotating target indicates when the vehicle position is within this target radius.
b) Direction Tolerance:
   ⇒ Tolerance of the target when navigating to a angled hole.
c) Show Surface Cut/Fill:
   ⇒ Show Cut/Fill values when in Navigation screen.
d) Show Attribute in Plan:
   ⇒ Show Attribute when in Navigation screen.
e) Auto-Zoom to Target:
   ⇒ Feature turns on automatic zooming when navigating closer to the target.

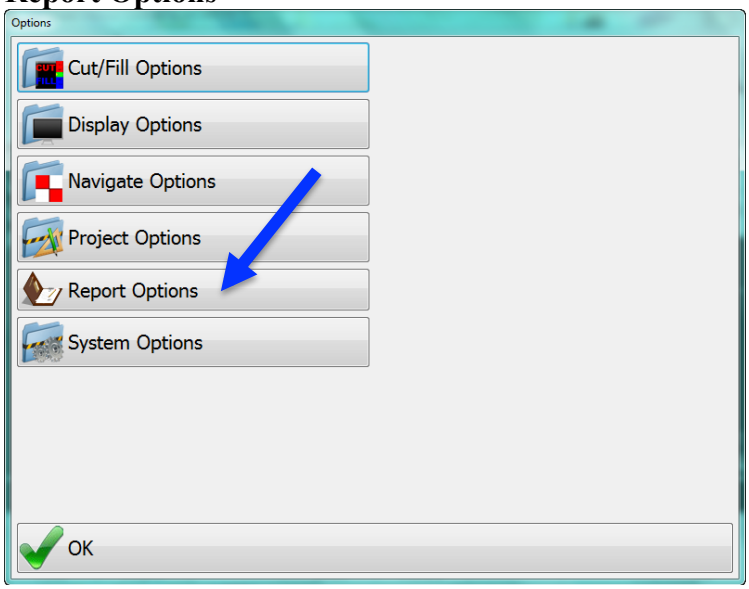
**4. Project Options**





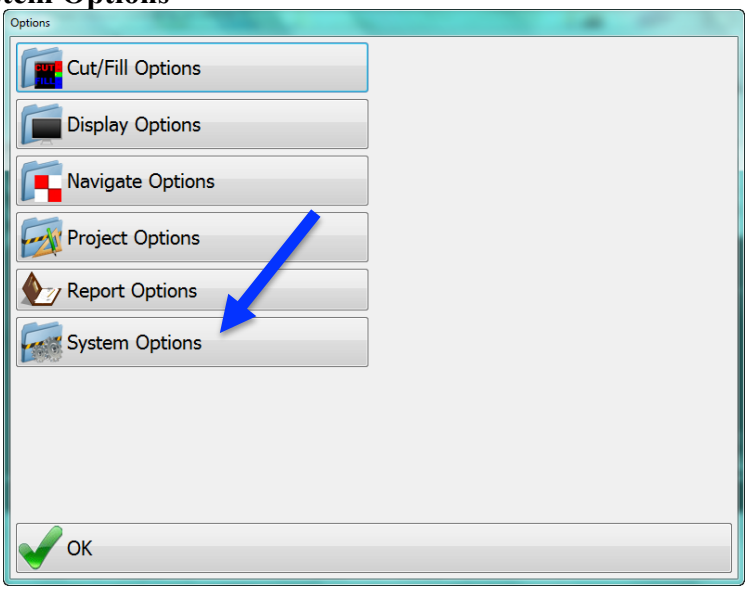

a) Project Desc:
   ⇒ User defined description for loaded project. Shows in status bar in main screen.
b) Units:
   ⇒ US-Survey Feet
   ⇒ International Feet
   ⇒ Meters
c) Update Existing Surface:
   ⇒ Cut: Updates existing surface in Cut only
   ⇒ Cut/Fill: Updates existing surface in Cut/Fill both
   ⇒ Off
d) Surface Write Interval:
   ⇒ User defined time period when surface is updated (ex: every 60 seconds)
e) Offset Increment:
   ⇒ The vertical offset value will change at this amount when the vertical offset up/down arrows are pressed in main screen.
f) Cut/Fill Grade Tolerances:
   ⇒ Select the color and tolerances of above/below grade (Cut/Fill) and also the On Grade width or tolerance.
g) Steering Tolerance:
   ⇒ Enter Tolerance for steering to a guideline. On grade Indication (Left and Right) when guideline is turned on.
h) Vertical Offset:
   ⇒ Value at which the vertical offset will be set each time the project is loaded.

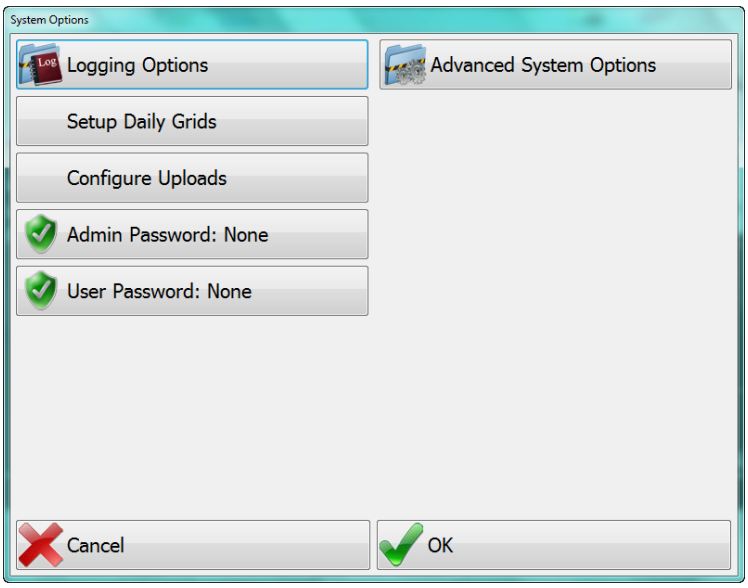
## 5. Report Options



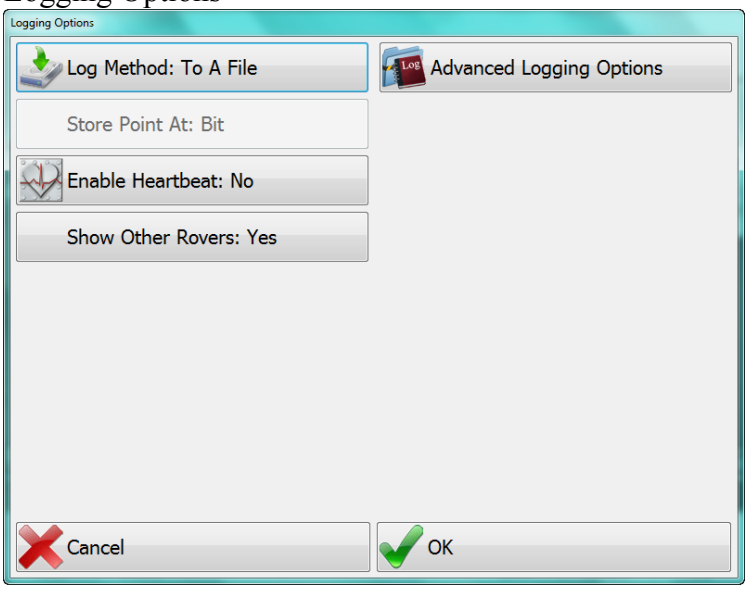

a) Logo upload for reporting. Logo will appear in header of reports.

## 6. System Options






a) Logging Options



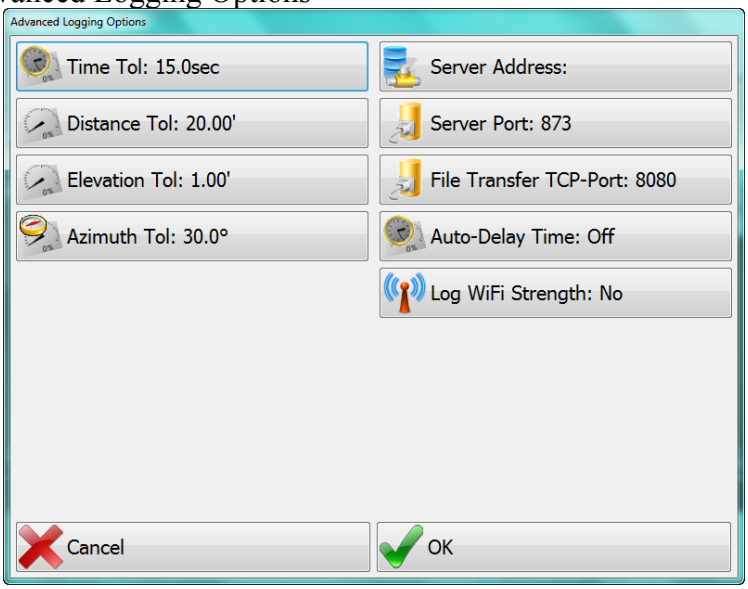

⇒ Log Method:
- Turning on Log Method to Log to a File. Logging is the process of storing position and event data to a file for transfer to a database for processing in the Fleet Manager Office system. This can be set to "None" or "To a file."

⇒ Store Point At:
- Location at which logged position is stored.

⇒ Enable Heartbeat
- When this is enabled Grade will broadcast Heartbeat Messages (UDP) to all addresses on the local network, allowing other Grades on the network to "see" it. When the is disabled, Grade will only send these messages directly to the Heartbeat Server. The server can be configured to rebroadcast these message from the office

⇒ Show Other Rovers:
- Other close by vehicles will be visible in main screen. (Blue Bubble indicates other machines)
- Position of vehicle broadcasted to other machines to show its location.

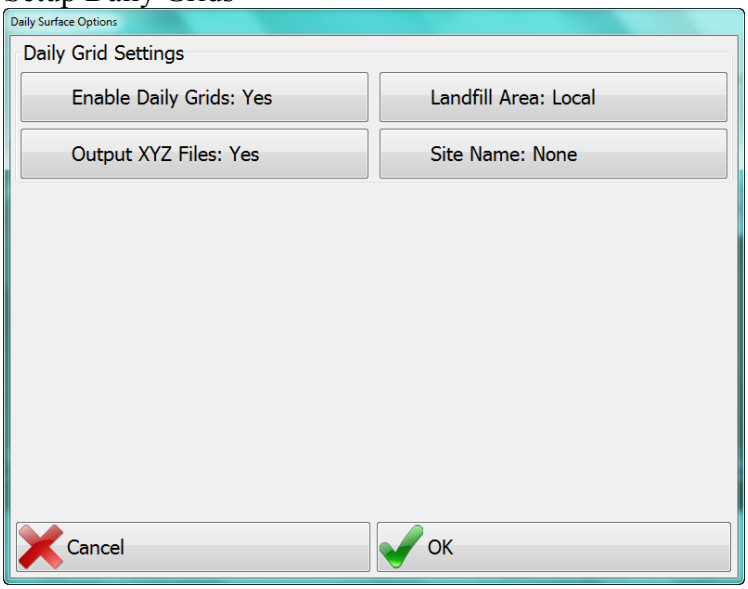
⇒ Advanced Logging Options




- Time Tol:
  - Time tolerance for logging position
- Distance Tol:
  - Distance tolerance for logging position
- Elevation Tol:
  - Elevation tolerance for logging position
- Azimuth Tol:
  - Azimuth tolerance for logging position
- Server Address:
  - This is the address where the Heartbeat server resides. This can be a local address on a local area network, or a public address on the internet if Grade is on a Cellular network.
- Server Port:
  - This is the TCP/IP port Grade will transmit and receive Heartbeat messages to or from the Heartbeat server. These are UDP messages. This must be the same port configured on the Heartbeat Server
- File Transfer TCP-Port:
  - This is the TCP/IP port Grade and the Heartbeat Server will use to transfer logging and project files between the Grade Computer and the Server.
- Auto-Delay Time:
  - When a time is input here Grade will begin a timer anytime the machine is idle. When this time is reached, Grade will automatically prompt the operator to choose a delay code.

- Log WiFi Strength:
  - Log WiFi Strength along with position in Log File

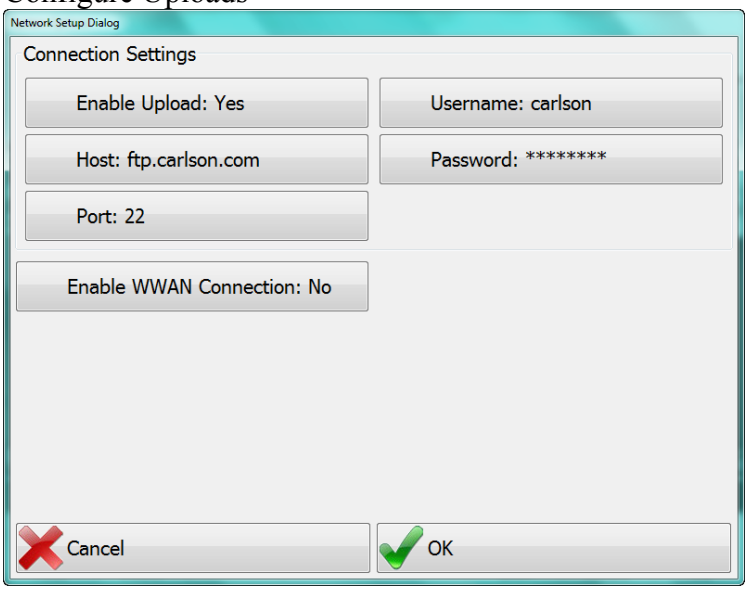
b) Setup Daily Grids




⇒ Enable Daily Grids:
- Turn On/Off automatic Daily Grid generation at Carlson Grade startup.

⇒ Output XYZ Files:
- Turn On/Off automatic upload of X,Y,Z position format as a point file.

c) Configure Uploads




⇒ Enable Upload:
- Turn On/Off upload to remote server

⇒ Host:
- Host address to upload files and Grids to.

⇒ Port:
- Port number for upload

⇒ Username:
- Username credentials for upload access.

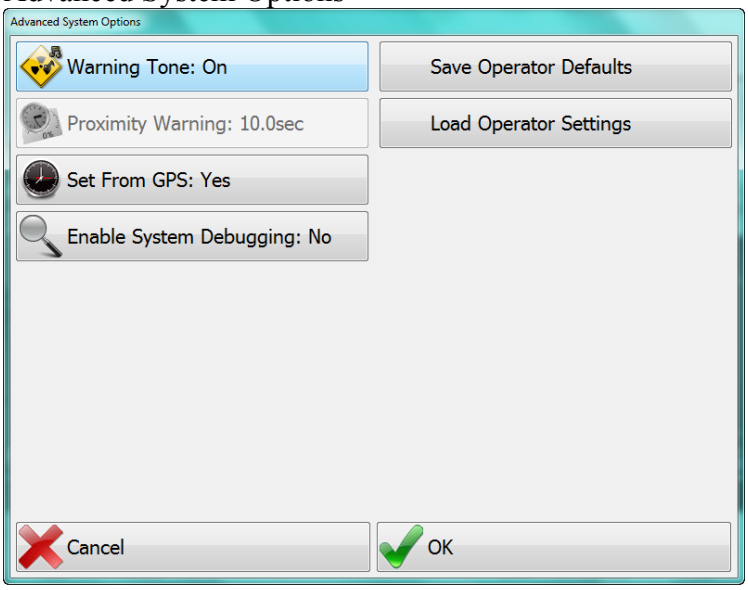
⇒ Password:
- Password credentials for upload access.

⇒ Enable WWAN Connection
- Allows WWAN (Wireless Wide Area Network)

d) Admin Password
⇒ Sets password for administrator level access

e) User Password
⇒ Sets password for user/operator level access

f) Advanced System Options




⇒ Warning Tone
- Turn On/Off warning tone (Audio)

⇒ Proximity Warning:
- Collision warning for close proximity vehicles.

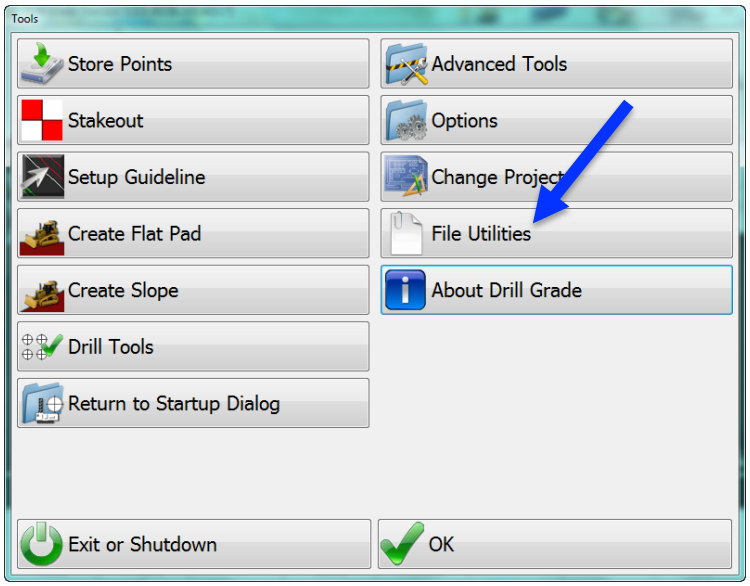
⇒ Set From GPS:
- Keeps system clock in sync using GPS receiver clock

⇒ Enable System Debugging:
- Turns on debugging mode to help Carlson with development and troubleshooting.

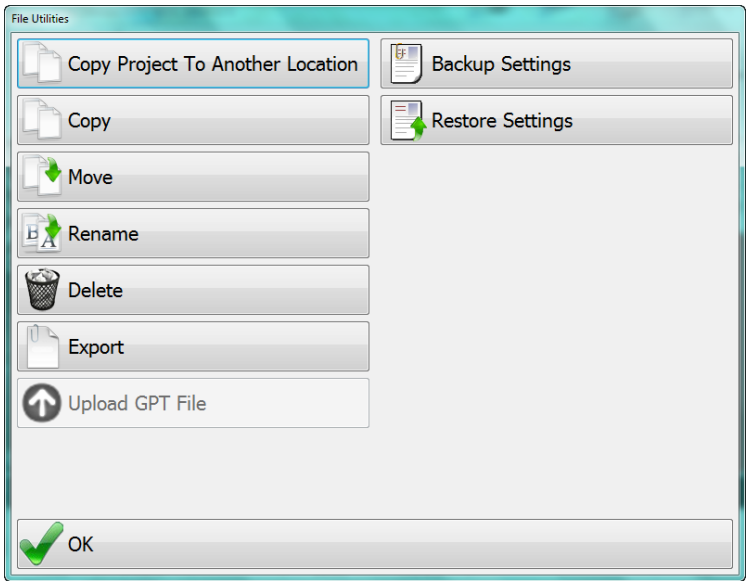
⇒ Save Operator Defaults:
- Saves a backup of operators settings, views, and screen customization.

⇒ Load Operator Defaults:
- Load a previously saved operator defaults.

**File Utilities:** This is a feature inside of Carlson Grade that is similar to a "Windows Explorer" type file management system.




## 1. File Utilities



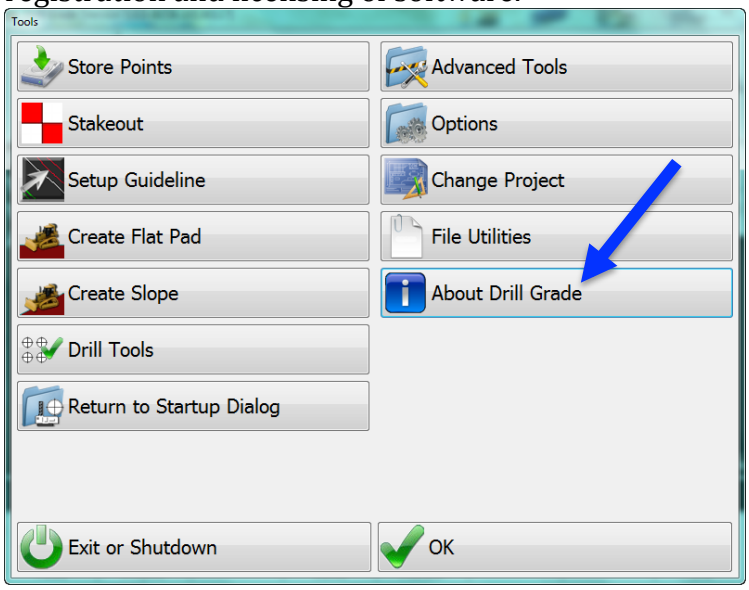

a) Copy Project To Another Location
   ⇒ Select Project (.prj) from data directory and copy to another location.
   ⇒ You can copy to an external USB drive by changing the drive location in the screen.

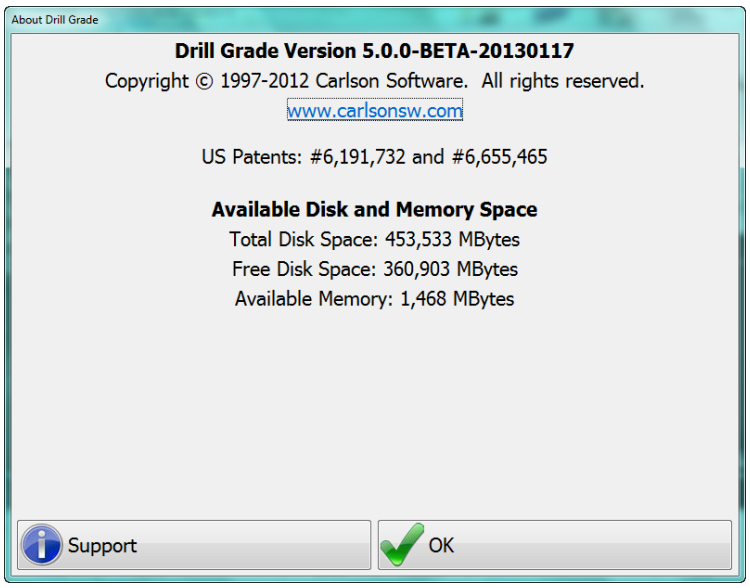
b) Copy
   ⇒ Select file from data directory and copy to another location.
   ⇒ You can copy to an external USB drive by changing the drive location in the screen.

c) Move
   ⇒ Select file from data directory to move to another location.
   ⇒ You can move file to an external USB drive by changing the drive location in the screen.

d) Delete
   ⇒ Select file from directory to Delete.
e) Export
   ⇒ Export Plan Data to Topcon LN3 file
   ⇒ Export Design Surface to Topcon TN3 file
   ⇒ Export Existing Surface to Topcon TN3 file
   ⇒ Export Localization to Topcon GC3 file
f) Upload GPT File
   ⇒ Upload .gpt (Grade Point File) to predetermined server.
   ⇒ Configure upload destination within Tools/Options/System Options/Configure Uploads
g) Backup Settings
   ⇒ Backs up and saves copy of ALL settings as configured at the time of backup.
   ⇒ Backup files are saved in Data/backups directory
h) Restore Settings
   ⇒ Load backup file to restore program previously saved configuration.
   ⇒ Backup files are stored in Data/backups directory

**About Drill Grade:** Information pertaining to program version, disk space, and also registration and licensing of software.






**1.** Support

Support and Contact Information
Technical Assistance and Support
For urgent technical assistance contact Carlson Software at (606) 564-5028 or for more detailed information send an e-mail to the following addresses:
Report a program problem: CPMCbugs@carlsonsw.com
Ask a technical question: CPMCsupport@carlsonsw.com
Setup field service: CPMCservice@carlsonsw.com
Make a product suggestion: CPMCidea@carlsonsw.com
Contact our sales staff: CPMCinfo@carlsonsw.com
Product License
OK

⇒ Lists technical support number and emails

b) Product License

⇒ Registering Drill Grade Software

- *Carlson Grade* will run on a temporary UOA file for 30 days before disabling communication through the serial port.

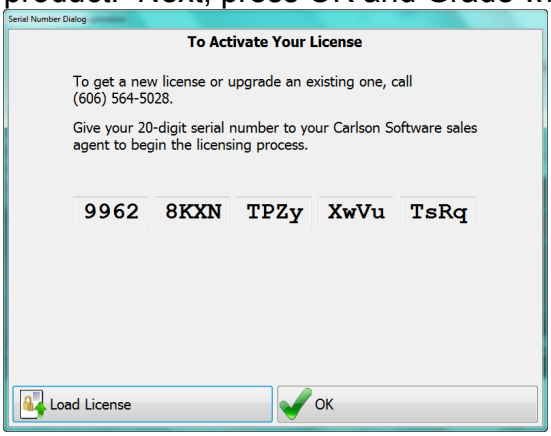
⇒ To register or check your available options, select the “Product License” button.

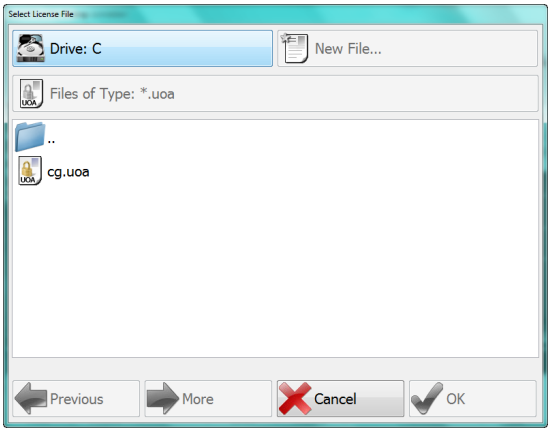
- You will now see the following Information:
- *Licensed To:* “company name”
- *Target:* Construction, Mining, Landfill
- *Last Used:* date
- *Expires:* date software disables

- *Enabled Product checklist:* all current equipment, options, etc. you have purchased.

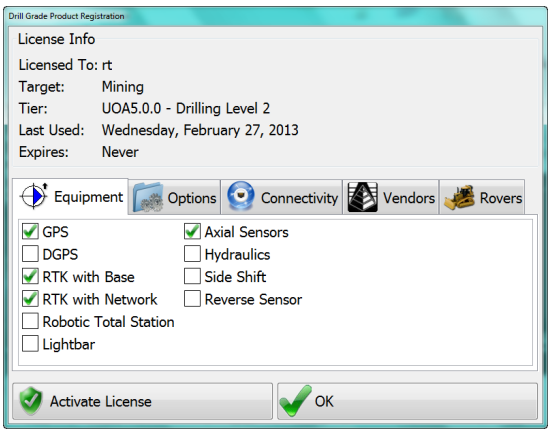
⇒ If you are in demo mode and are running a UOA file that will expire, you need to select “Activate License” to proceed.

- Contact your *Carlson Grade* Dealer to get an UOA file (License) to activate the product. You will need to be prepared to give the Serial Number found in the license screen shown to your right (underneath “To Activate Your License”).
- Once you have given this information to the Carlson dealer, they will send you a UOA file which will need to be loaded into the PC via a USB thumb drive. Press ‘Load License’ from the previous screen and select the ‘Drive’ that contains the Authorization Code (UOA) needed to license your product. Next, press OK and Grade will be activated.


Serial Number Dialog
To Activate Your License
To get a new license or upgrade an existing one, call (606) 564-5028.
Give your 20-digit serial number to your Carlson Software sales agent to begin the licensing process.
9962 8KXN TPZy XwVu TsRq
Load License
OK

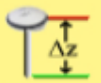
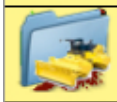



- The Product support options you have purchased will have the boxes checked after the UOA is loaded as shown.

- 


**Available Toolbar button options:** Listed below and described are additional toolbar button options that can be configured in Tools/Options/Display Options/Advanced Display Options/Toolbar Display Options..

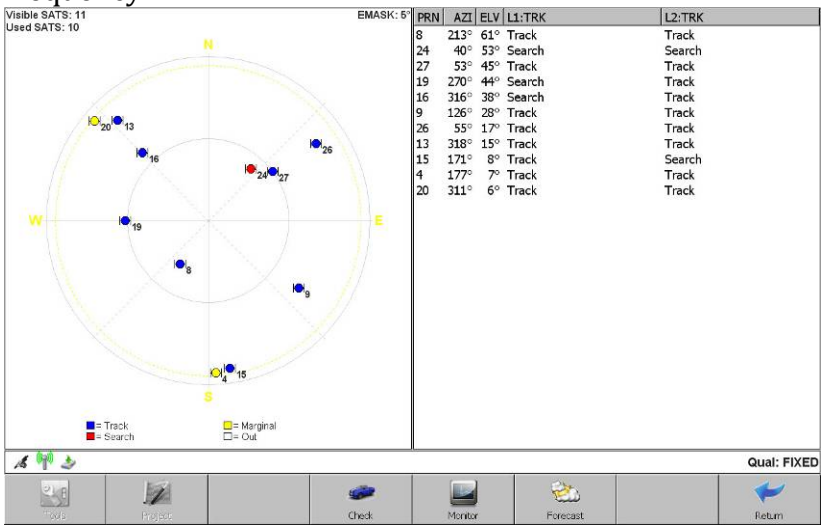
| | | |
|---|---|---|
| | Exit Program | Shutdown or Exit Carlson Grade |
| | Activities and Delays | Shows list of Available Activities and Delays |
| | Reverse Vehicle | Informs Machine that it is in Reverse (Not needed if Reverse Sensor is installed) |
| | Reverse Video | Changes screen display from Black to White for visibilty preference |
| | Stakeout a Point | Opens the Stakeout routine |
| | Rotate Through Views | Each press cycles through available views such as cross section, plan, profile, 3D, etc. |
| | Show GPS Skyplot | Shows detailed information on GPS tracking and signals |
| | Monitor System Status | Shows detailed information on GPS position, RTK correction, Solution Status (Fixed or Float), Machine position, speed, sensor information, etc. |
| | Create Slope | Opens the Create Slope routine |
| | Create Flat Pad | Opens the Create Flat Pad routine |

| | | |
|---|---|---|
| | Automatically Store Points | Opens Store Points setup |
|  | Bench to Known Elevation | Opens the Bench to Known Elevation routine |
| | Show Support Movies | Opens the In-Cab Video Support feature |
| | Switch to/from Rod | Switches Rover reference position to/from Truck and Rod |
|  | Flip the Guideline | Flips the Guideline offset from one side to the other for direction control |
| | Increase/Decrease Vertical Offset | Increases and Decreases Vertical Offsets to and from the design surface, Flat Pad, or Slope |
| | Drill Setup | Opens Drill Seetup options and configuration |
| | Drill Action | Used to initiate Drilling sequence (Carlson Drill Grade Only) |

## Diagnostics and Troubleshooting:

GPS button allows the operator to check the status of GPS and other hardware.

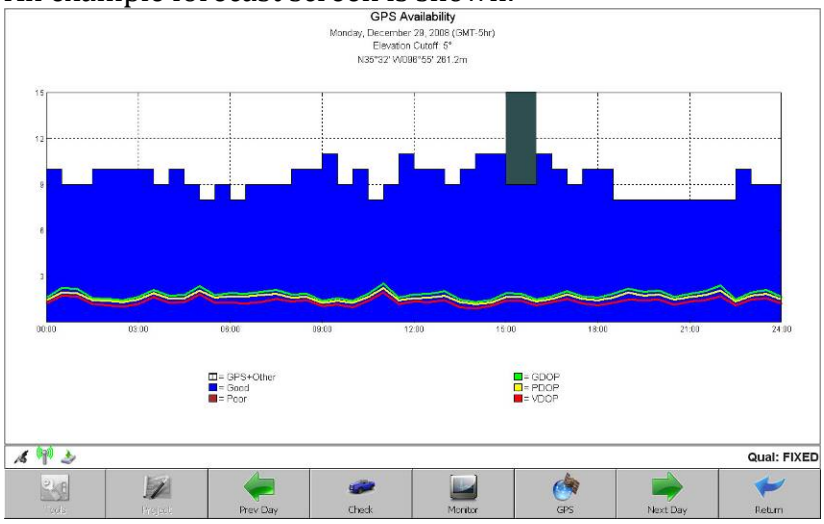
This screen lists all of the visible satellites, along with their PRN (satellite ID number), current azimuth, elevation, and whether or not they are tracking the L1 and/or L2 frequency.




| PRN | AZI | ELV | L1:TRK | L2:TRK |
|---|---|---|---|---|
| 8 | 213° | 61° | Track | Track |
| 24 | 40° | 53° | Search | Search |
| 27 | 53° | 45° | Track | Track |
| 19 | 270° | 44° | Search | Track |
| 16 | 316° | 38° | Search | Track |
| 9 | 126° | 28° | Track | Track |
| 26 | 55° | 17° | Track | Track |
| 13 | 318° | 15° | Track | Track |
| 15 | 171° | 8° | Track | Search |
| 4 | 177° | 7° | Track | Track |
| 20 | 311° | 6° | Track | Track |

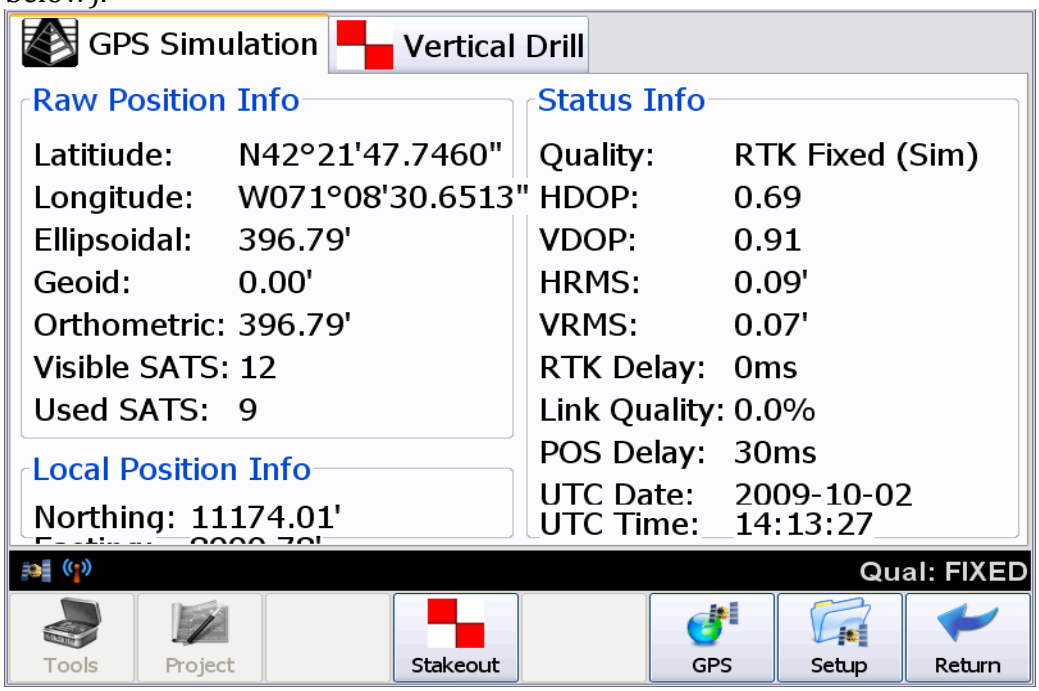
Forecast:
(Only available if GPS hardware provides information) Pressing this will show the forecasted number of satellites at certain times in the future. This can help for determining

when there will be insufficient satellites to get a lock, thus downtimes can be planned for. An example forecast screen is shown:




The “Next Day” button will advance to the next day.
(Note: The “Check” button will return you to the main grade screen.)

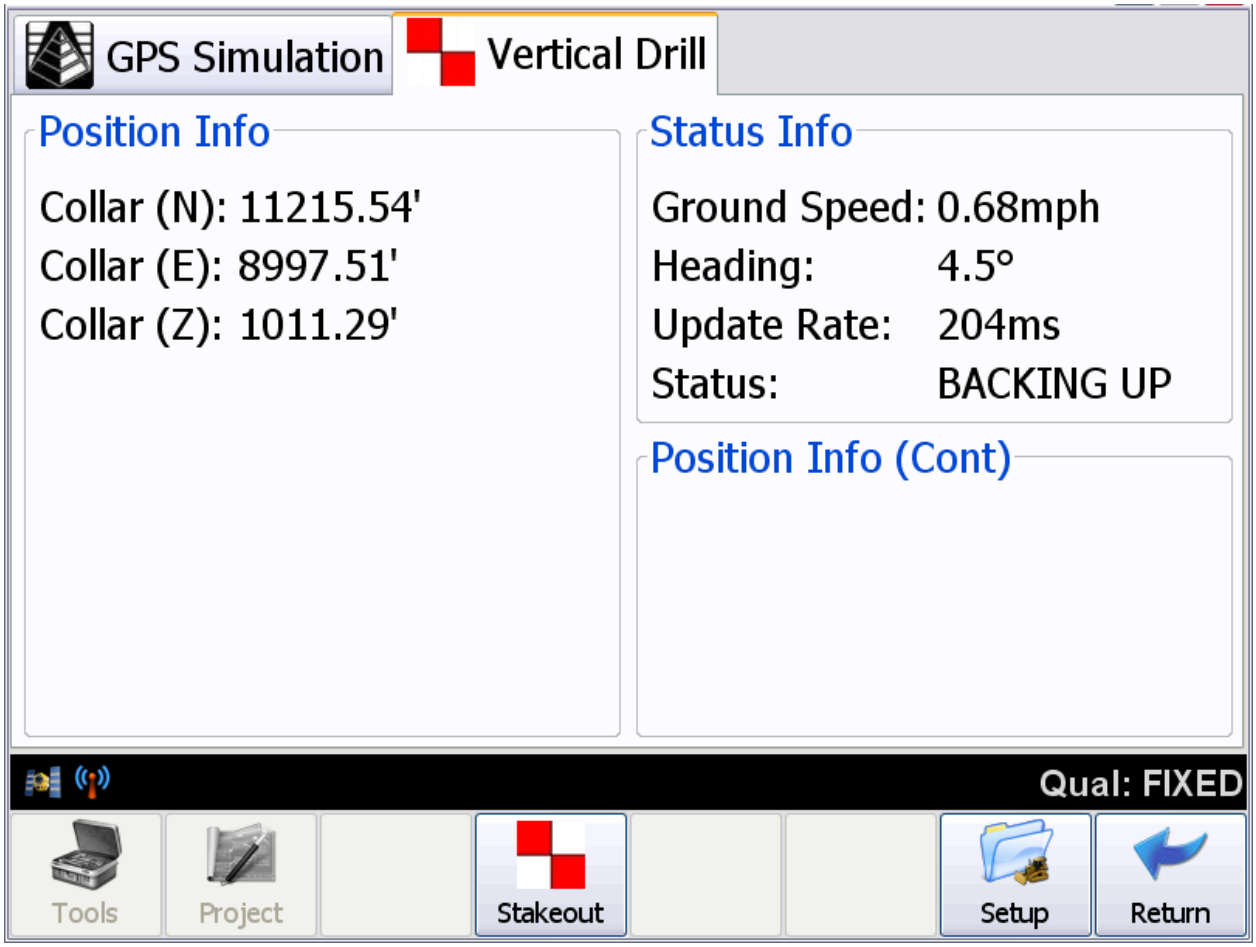
Monitor button:
The Monitor button allows the operator to check the status of GPS and other hardware (see below).




This screen shows a great amount of information, here is a breakdown:

LATITUDE / LONGITUDE: This is the latitude and longitude of the GPS antenna.

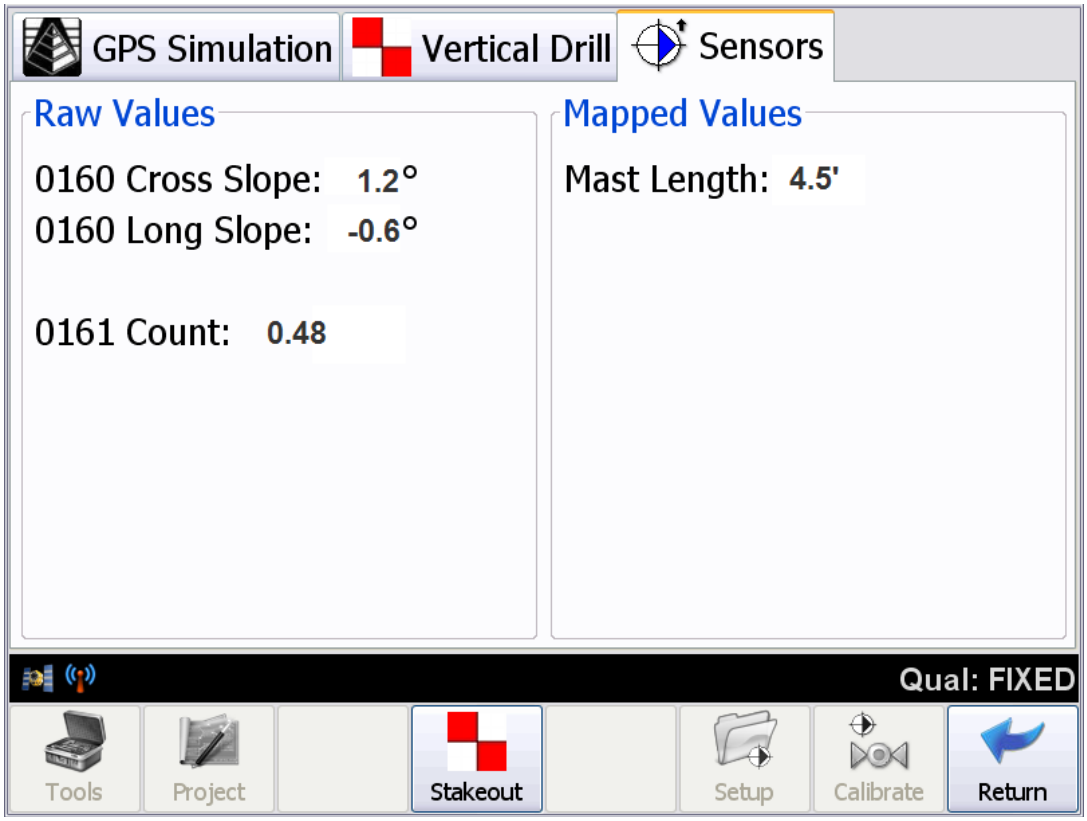
ELLIPSOIDAL: This elevation determines your position by assuming the earth is a perfect ellipsoid.
GEOID: Geoid is the difference of elevation between the ellipsoidal height and the orthometric height.
ORTHOMETRIC: This is your elevation relative to the imaginary surface referred to as the MSL (Mean Sea Level).
VISIBLE SATS: The number of satellites visible in the sky.
USED SATS: This is the number of satellites used to calculate the GPS position.
UTC DATE: This is the current date as received from the GPS receiver.
UTC TIME: This is the current time as received from the GPS receiver.
Quality: The quality of the GPS position. A value of RTK Fixed indicates the highest position quality.
HDOP/VDOP: The horizontal and vertical dilution of precision. This is a measure of the error of the GPS position. A smaller DOP value means a better position.
HRMS/VRMS: The horizontal and vertical RMS values of the position. This is another measure of the error of the GPS position. A smaller RMS value means a better position.
RTK Delay: The time since the last RTK correction from the GPS base station.
POS Delay: The inherent delay of the GPS position from the GPS receiver.
If you select the Drill icon on the top on the screen you will see something similar to the provided screenshot:



Position Info (N/E/Z): The northing, easting, and elevation value of the GPS antenna. If vehicle is equipped with a Blade, then information is given for the Left Corner, Center, and Right Corner of the blade.
Ground Speed: This is simply how fast you are traveling.
Heading: This is the vehicles direction of travel in degrees.
Update Rate: This is the time taken to update the GPS position. The lower the number, the more responsive the cut/fill calculation will be.
Status: Stopped or Moving

If you select the Sensor Tab, you will be able to see the raw sensor values as well as the mapped (calibrated) values. You can also re-calibrate the selected sensors from this screen.(see system setup / configuration section for sensor calibration procedure)

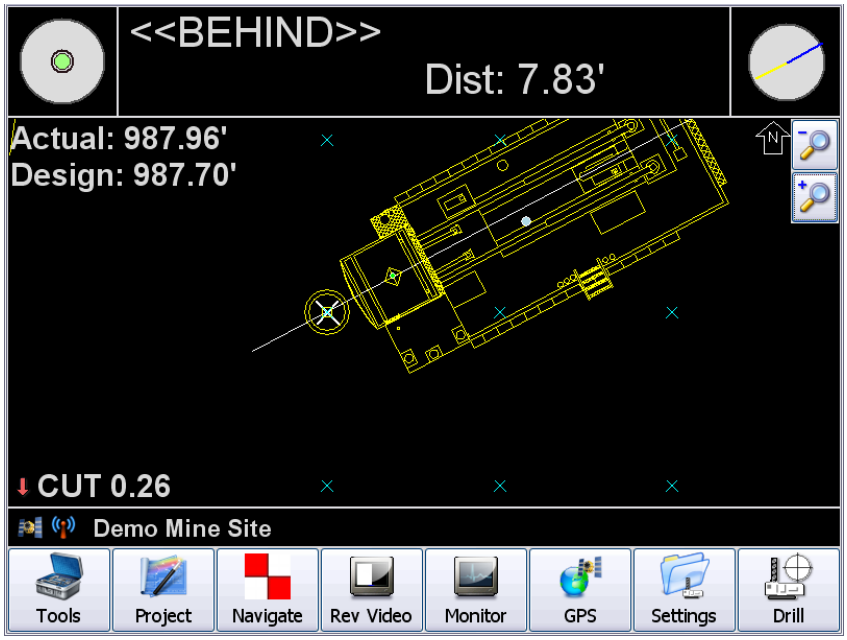
(Sample: Dual axis senor)

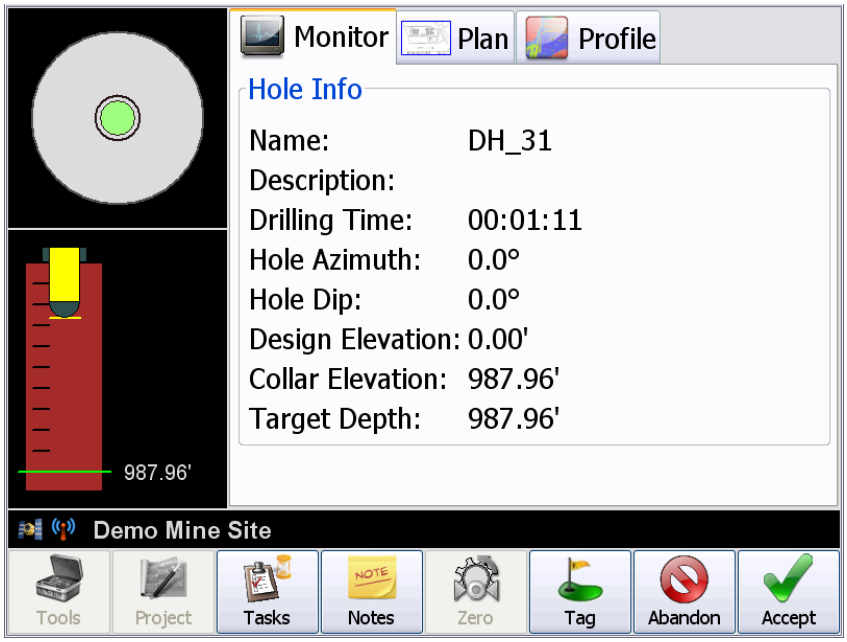



Reverse Button:
This button is useful if you do not have a reverse sensor and are using the auto-detect reverse feature. When you first start the software, it assumes that the first motion of the machine is forward. If the operator goes in reverse the software can incorrectly determine that machine is moving forward. This button corrects that problem. This button is unnecessary when using a dual-antenna system or a reverse sensor.

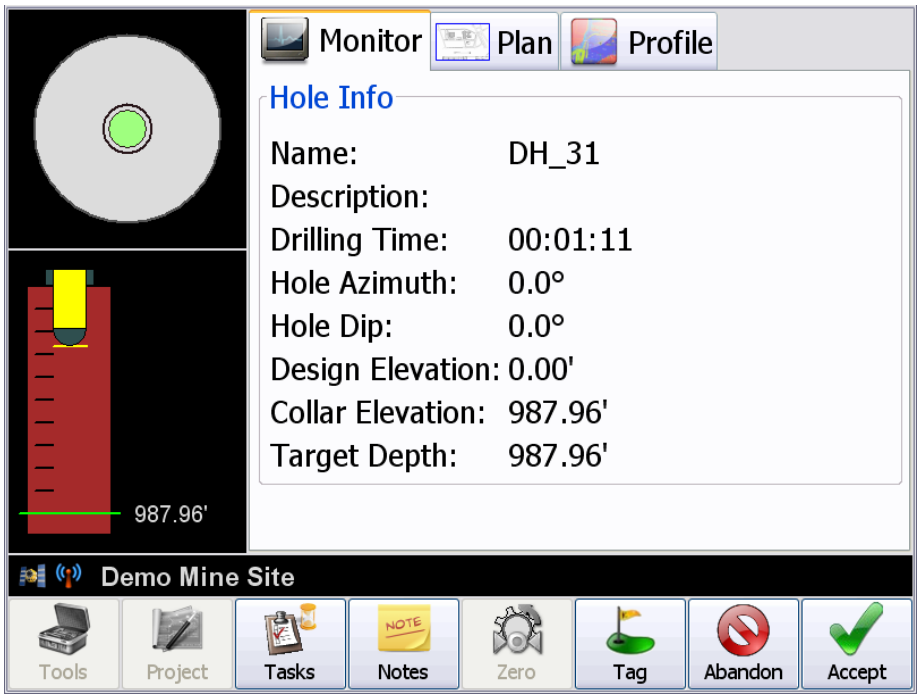
Screen Views:
The 'Views' button switches between different views for Cross Section, Profile, Cut/Fill, Grade Indicator, Plan View, etc.

Here are two variations of views inside of Carlson DrillGrade



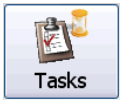
**Drill:** The Drill button is pressed when navigation to target is complete. Once you are in correct position and location to beginning the drilling sequence, press the Drill button from the toolbar.



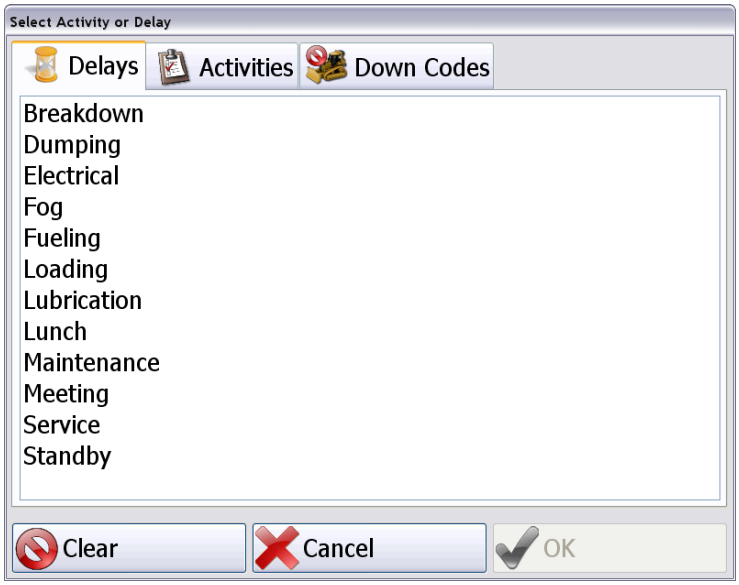

Information inside of the Drill Screen:
Name: Name of Hole
Description: Description of Hole Name
Drilling Time: Time (Stopwatch) spent drilling a single hole
Hole Azimuth: Heading (degrees) from hole
Hole Dip: angle (degrees) out of level from Drill Mast
Design Elevation: Elevation at bottom of hole
Collar Elevation: Elevation of "Top of Hole" and/or bottom of Drill Bit when drilling first begins
Target Depth: Total depth of hole from top of ground to bottom of hole

Options on Toolbar inside of Drill Screen:
Tasks: Task and/or activities that can be selected throughout the day for production and logging purposes. (Explained further in details below)
Notes: Allows you to add any type of notes you may want to list with the single hole information. (ex. Hit water at 23 feet)
Tag: Allows you to tag depths and show Coal seem top and bottom or hard rock, soft shell rock, etc. (Examples shown in details below)

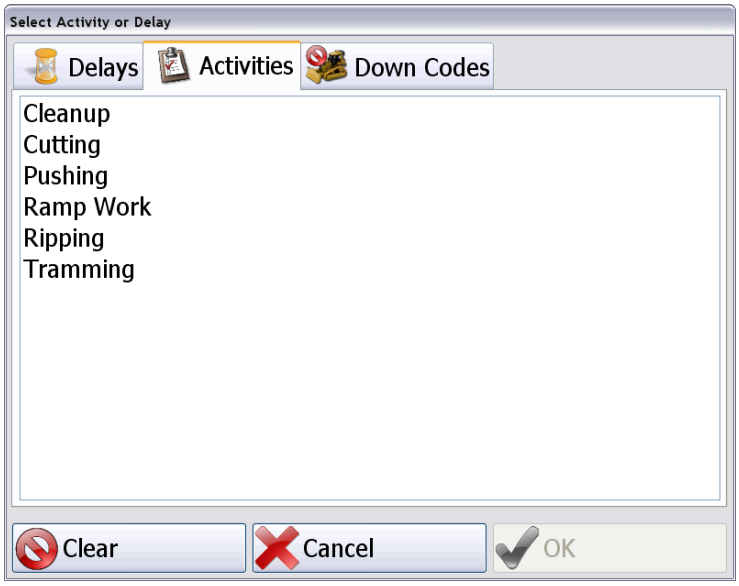
Abandon: Press this if you want to abandon the hole and start again and/or drill next to current hole due to inability to drill in suggested area.
Accept: This button accepts hole, logs all information for that hole, and colored the hole point on the screen to show that the hole has been drilled.

Tasks: 


Delays: Here are some examples of "Delays" that can be logged to show reason for downtime.

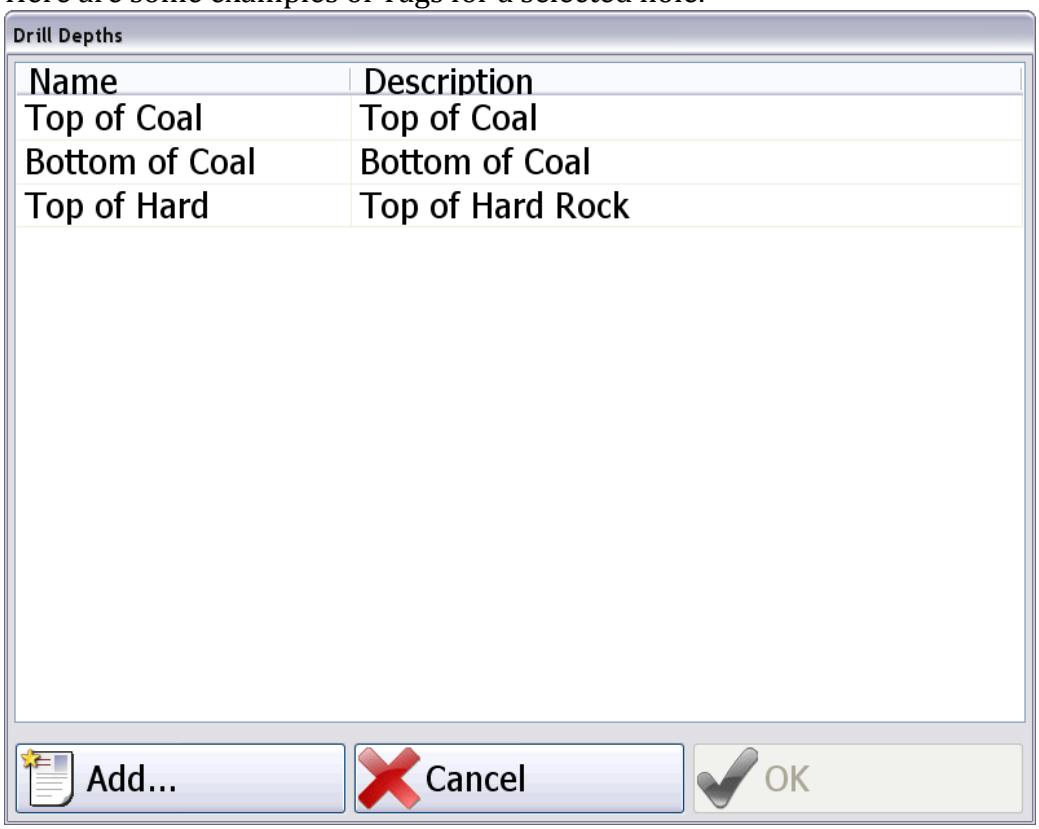



Activities: Here is a screen shot that shows different kinds of activities



**Tag:** Tagging Strata during drilling sequence.

Add new labels for strata by pressing the Add button on the Drill Depths screen. The list of stratas are displayed each time you press the Tag button on the Drill screen.
Here are some examples of Tags for a selected hole.



# TROUBLESHOOTING

## Hardware Selection Issues:

What type of vehicle is *Carlson Grade* being installed on and what sort of accuracy will suffice for your task?

## Localization Problems:

Sometimes you may be far from the desired location. If your position seems off, check the following few items to resolve the issue.

**Check Settings:** Verify that you have a localization file set and that you have selected either a State Plane or UTM Projection to use. Ensure that the correct GPS receiver type is in use and the correct vehicle type is entered.

**Review Files:** Once you have verified that you have a localization file set, verify that the file looks normal. Open the file in a standard text editor, like Notepad, to see that it has the expected number of points and that it is not garbled looking (corrupt data).

**Verify Position GPS Antenna Location:** If your values seem to be off, then check the antenna positions with a GPS backpack to verify that you have the positions of offsets entered correctly versus it being a localization problem. When comparing the GPS values from the backpack to the vehicle rover, look at the GPS position in the *Carlson Grade* Monitor screen. (**Note:** There is the cut/fill position reporting in addition to the raw GPS position)

## GPS Radio and Signal Problems:

What to check: cabling, power level (battery level), bad antennae, and being out of the line of sight.

## Adding Serial Port Options: (e.g. Com5, Com6)

If a port higher than four is used, the receiver configuration file can be edited to show more port numbers. The configuration files are in "c:\carlson grade\drivers" and are named after the receiver model with a ".cfg" extension. Open a configuration file in notepad and search for the line that has "1, 2, 3, 4". If adding port 5, change it to "1, 2, 3, 4, 5". If you somehow damage the configuration file, just delete and Carlson Grade will create a new one.

## Common Issues:

**Base GPS Receiver No Power:**
Be sure to hold the power button for a few seconds. The battery must be charged or an external battery needs to be connected. Check cabling to see if the connection is damaged.

**Base Radio Does Not Power:**
The battery must be charged or the radio connected to external power source.

**Base Station Does Not Connect to Receiver:**
Be sure the base is on and that the COM cable is in the correct port.

**Base station connects but Sees No Satellites:**
Check the connection of the GPS antenna cable. Be sure to have a good view of the sky. Be patient; it may take 30 seconds or more for the GPS to acquire satellites.

**Base Station Started But Radio Not Transmitting:**
Check the cable from the receiver to radio. If a TX light exists, the light should flash. Check for power to the radio.

**Rover GPS Receiver Power Does Not Light Up:**
Be sure you have power to the receiver. Check to see if ignition is needed to be in the "on" position for power. The system may be grounded through the master switch. If the switch is off you will have nothing. Check battery cable connection.

**Rover GPS Receiver Satellite Does Not Light Up:**
Check the connection of the GPS antenna cable to the receiver. Check to see that all bulkhead connections on the machine are tight. Check the view of the sky. It may take 30 seconds for GPS to acquire satellites.

**Rover GPS Receiver Radio Does Not Light Up:**
Check the base station to be sure it is transmitting. Check the channel and protocol you are transmitting. Check the receiver to be sure you are looking for the same channel and frequency. If you experience a problem at a great distance try raising the correction radio antenna at the base.

**Computer Does Not Power On:**
(KEE Computer ONLY): If you press the button on the rear of the PC to power, look at the lights in the lower right. If the left light is green and the right is red you only need wait approximately 20 to 30 minutes, with power on, to charge the internal capacitor. If the left light is red, then you have no power to the PC and need to check for ignition power, battery power, and that the master ground is on.

**GPS Localization Error:**
If you have errors of tens or hundreds of meters/feet then it is likely that a mistake in entering the coordinates has occurred. Also check to see that you are using the correct units (US feet, international feet, or meters). Check for the correct state plane coordinate system.

**Out of Design:**
Check that you are using the correct design surface. Check machine coordinates to see if you are within a reasonable range of known coordinates. Check the setup of base station for an incorrect base location.

## Maintenance and troubleshooting:

**Daily Care:**

Keep all components clean and dry prior to placing in carrying case.

Use connector caps when the machine is not in use.

Do not use high-pressure spray directly on cable and components.

Check all connection regularly for wear or physical damage.

Keep machine battery in good condition. Isolate all components on the system if welding or jumpstarting machine.

**Touch screen cleaning:**

Clean regularly to maintain a quality image and prevent faulty operation.

The front of the touch screen should be kept free of dirt, fingerprints, and other materials that could degrade the touch-screen.

For best results use a clean, damp, non-abrasive cloth towel and any commercially available window cleaner to regularly clean the surface. Apply cleaner to the towel rather than the touch-screen.

Never use alcohol, ether, benzene, acetone or any other type of solvent. Do not use high-pressure spray. Do not spray toward the screen.

**Prior to calling tech-support, please check the following:**

Check to see that the various components have power and are powered up.

Check all cable connections are secure and tight.

Disconnect connection to check for damage to connector.

## Carlson Grade and GPS Troubleshooting Guide:

Here are some examples of Status Bar messages that can help you troubleshoot existing problems.

## GPS Lost Lock:

If this appears you can select GPS and Monitor. Look at the Quality in the right hand column. It should read RTK Fixed if all is OK. If it says RTK Float, then it should fix in a few minutes; if not, try to shut the system down and restart. If it says RTK Autonomous then the correction radio is not working and you should check to see if you still have a correction radio antenna and verify that the base is working.

If the GPS will not go into a fixed solution after restarting the system, then your local dealer will need to look at the GPS receiver. Most receivers have indicator lights to tell you that it is receiving GPS signal from the satellites and that it is receiving radio corrections. This will tell your dealer if the problem is between the antenna and the receiver or between the receiver and the computer.

If the lights on the receiver do not light up, then you have a power issue. If you have power but have no GPS you will need to change the GPS antenna with one from your stock. If this does not fix the problem, you need to put the original antenna on a troubleshooting cable (it is a good idea to have a spare cable with a TNC connector on one end and a type N connector on the other approx. 10 to 15 feet in length to hook to the receiver to the existing antenna to see if the receiver is working). If the troubleshooting cable works then your cable is bad or the ends are loose. If the cable is solid-core please replace it. If it is twisted-core, try new ends.

If you have no signal from the correction radio, then you need to verify that it is still on the machine (it is typically a thin metal antenna). If it is still there, then you need to verify that the base is transmitting a signal by getting a GPS unit in the area where you are to see that it works.

## Signal Bars on Antenna:

The number of bars represent different information.
2 bars indicate a “Fixed Solution”
1 bar indicate a “Float Solution”
0 bar indicates an “Autonomous Solution”

**Reverse Sensor** is not detected. Check Cable and selected Com Port.

**Automatic Mode** will show a 'Green' indicator when enabled.

**Manual Mode** will show a 'Red' indicator when disabled

**CAN Dongle not detected** will show in status bar if Grade diagnoses a connection problem. (Typically when using an external CAN Dongle)

### Internal CAN error message

(CAN Bus Error) displayed when connection between internal "Built-In" CAN and external CAN sensors.

### Computer Problems:

If the computer will not start, then the best solution is to use a volt meter to verify whether there is power or not. If there is no power, check the battery or the fuse panel since those are where the computer derives its power from. If there is power, examine the power connector to the computer. If all seems well take the computer off the machine and return if to your office where you should have an 110vac to 12vdc power supply that will power the computer. If the computer battery is dead it will not start immediately. If you must replace computers you will need to load the *.vdf file for that vehicle type to be sure the settings are correct.

### Navigating:

You can move approximately 5 to 10 feet for the software to compute a direction of travel.

# Appendix A – Simulation Keys

**Keys:**
Keyboard entries for use in Simulation Mode of vehicles.

**Common to All Vehicles:**

- **Left arrow** – Turn left
- **Right arrow** – Turn right
- **Up arrow** – Move vehicle up
- **Down arrow** – Move vehicle down
- **R** – Reverse direction of vehicle
- **F** – Make vehicle go faster
- **S** – Make vehicle go slower
- **T** – Reset vehicle to starting position on project
- **Q** – Pause / un-pause simulation
- **Left mouse click** – selects on-screen objects such as points and guidelines
- **Right mouse click** – moves vehicle position to cursor location on screen

## Appendix B – Hardware

# Computer Data: Carlson CBx5

1. Audio/Video
   - ⇒ Audio Out: 1x stereo headphone jack, 1x internal buzzer
2. Computer
   - ⇒ Memory: Atom Z530 CPU 1.6GHz
   - ⇒ Storage: 1GB RAM, 4GB NAND FLASH (primary), 16GB SD (secondary)
   - ⇒ Operating System: Windows 7 Embedded
   - ⇒ Display Type: 10.4” SVGA TFT-LCD (800X600 res)
   - ⇒ Luminance: 1200 Cd/m2
   - ⇒ Communication
     - Serial Port: 2x (RS232 with 12 V power 1 Amp max.)
     - CAN: 2x (with 12 V power 1 Amp max.)
     - USB: 2x
     - Wireless: Internal 400-480 MHz receive data radio, PacCrest compatible, 6.25, 12.5, and 25 kHz channel spacings
     - Cellular: 3G cellular modem with SIM card access
   - ⇒ Mechanical
     - Case: Die Cast Magnesium
     - Size:115/8”x9”x3”
     - Weight: 7.5 lbs
     - Mount: Adjustable 2” RAM Ball Mount
     - Screen Size: 8.315” X 6.236” Active Area
   - ⇒ Power
     - Input voltage: 9VDC – 36VDC
     - Power Consumption: 45W Typical
     - Current consumption: 6A max, charging battery, while powering CAN and Serial port devices.

# Heading Receiver Data – Carlson MC Pro Vx5

1. Mechanical
   - ⇒ Case: Rugged IP69k rated plastic enclosure
   - ⇒ Size: 26.32 long x 8.23 wide x 4.8” tall
   - ⇒ Weight: 2.4 kgs (5.4 lbs)
   - ⇒ Mount: 8 M8 mounting holes (Attaches to 4330.230 Vibration Mount)
2. GNSS Receiver
   - ⇒ Receiver Type: Eclipse II – GNSS L1 & L2 RTK with carrier phase
   - ⇒ Channels: 12 L1CA GPS 12 L1P GPS
     - 12 L2P GPS (with subscription code)
     - 12 L2C GPS (with subscription code)
     - 12 L1 GLONASS (with subscription code) 12 L2 GLONASS (with subscription code)
     - 3 SBAS or 2 additional L1CA GPS
     - 1 L-Band SBAS
     - Update Rate: 10 Hz Standard, 20 Hz Available
3. Dual Antenna heading accuracy < 0.25 degrees RMS Pitch Tilt and Roll to < 1degree
4. Antenna
   - ⇒ Dual Freq APEX – GPS L1/L2/L5
5. Power
   - ⇒ Input voltage: 8VDC – 36VDC Isolated Power Consumption: 6.5W, RTK. Current consumption: 0.54A max, RTK.

# Appendix C – Wiring Diagram (Atlas Copco)

## Drill Grade Wiring Diagram

(Atlas Copco HEC3 connection shown)